ANEMIA IN PREGNANCY

IMPACT OF IRON DEWORMING AND IEC

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K.V. KUPPAM BLOCK

STUDY AREA

☆ **Pre-intervention Survey Panchayats**

○ **Post-Intervention Survey Panchayats**

GUDIYATHAM BLOCK CONTROL AREA

* Pre-intervention Survey Panchayats

O Post-Intervention Survey Panchayats

I. INTRODUCTION

1. GENERAL

The World Health Organisation (WHO) has been concerned with the global problem of nutritional anemia for many years. The first Food and Agriculture Organization (FAO)/WHO Joint Expert Committee on Nutrition, meeting in 1949, pointed out the importance of nutritional anemia and recommended that funds should be provided for its study (WHO 1950); the first research in nutritional anemia was sponsored in 1955 and the first international meeting was called in 1958. Since then many research studies carried out globally found that control of nutritional anemia is possible by providing the deficient nutrients, either as therapeutic supplements or by fortification of commonly used food stuffs. In a meta analysis of clinical studies between 1966 and 1983, iron supplementation (starting atleast before 30 weeks of pregnancy) was found to be highly efficacious in reducing the prevalence of anemia at term (Mohammed and Hytten 1989). In another meta analysis of 24 randomized controlled trials, efficacy was also clearly demonstrated in correcting maternal anemia (Sloan et al 1992). Other important findings derived from those meta analyses included: a. There was a dose - response and a duration response relationship up to thresholds of about 60 mg iron daily and 20 weeks duration.b. Short term, large dose supplementation was relatively inefficient and ineffective and cannot substitute for longer term, smaller dose supplementation. Baker and Maeyer (1979) concluded after reviewing some control programs that the WHO still has an important role to play in this field, encouraging the development of control programs and providing advice and technical assistance to member countries.

A public health problem like Iron Deficiency Anemia (IDA) which is complex and has a multifactorial etiology, needs to be tackled concurrently through several approaches which call for innovative thinking. It is unfortunate that IDA continues to be a major problem in most countries of South East Asia inspite of the knowledge that has been accumulated over the years about its etiology and prevention. One of the objectives of an intercountry workshop organised by WHO/SEARO/ in Thailand in 1995 was to develop strategies and recommendations for improving national IDA control. It was pointed out that several constraints were experienced in the existing iron supplementation programs by the SEAR countries and IDA control was ineffective and it was necessary to examine the feasibility of all approaches and to come up with an action plan for mechanism for implementation of these approaches. Of the countries reviewed, Bangladesh, India, Indonesia, Myanmar, Nepal, Srilanka and Thailand have national programs for the control of IDA, however Democratic People's Republic of Korea and Maldives do not have special programs for anemia control. In Nepal it is `The National Nutrition Program' which includes iron and folic acid supplements, in Srilanka it is advocated through National MCH services; and in Bangladesh, IDA is incorporated as one of the vital issues of its Community Nutrition Program.

In 1970, the ministry of Health and Family Welfare, Government of India instituted a prophylaxis program against nutritional anemia to pregnant women with hemoglobin level 10 gm and below. Other beneficiaries such as lactating women and pre-school children were also covered. An evaluation of this program carried out in 1984

showed no impact in improving the hemoglobin levels of the pregnant women. It was observed that the failure was mainly due to poor coverage and irregular supplies. The coverage was less than 20% throughout the country and in Tamilnadu it was as low as 6%. Regarding awareness of anemia, only knowledge on the symptoms of anemia was measured; this was observed to be poor. One of the recommendations made by this evaluation was to increase community awareness through effective IEC (Ministry of Health and Family Welfare, 1989).

The main operational constraints identified in a review of six large - scale programs (Gillespie et al 1991) aimed at pregnant women were :

- Inefficient and irregular supply, procurement and distribution of supplements.
- Low accessibility and utilization of antenatal care services.
- Inadequate training and motivation of front line health workers.
- Inadequate counselling of mothers and
- Low compliance by the intended beneficiaries with the supplementation regimen.

Reasons for drop out from a supplementation program are more likely to be related to poor supply and availability of the tablets than to side effects (Gillespie et al 1991). In India over 80% cited failure of tablet supply while fewer than 3% cited side effects from consumption. (GOI 1989).

The prevalence of anemia among pregnant women was found to range in different countries from 21 to 80% (WHO 1968). Of the countries studied the prevalence of anemia and iron deficiency was highest in India. As a result a WHO collaborative study was carried out in Delhi and Vellore. The prevalence of anemia (Hb <11g/dl) among women above 24 gestational weeks was 88% in Delhi and 87% in Vellore.(Sood SK et al 1975).

Koen et al (1992) studied 315 pregnant women in the K.V.Kuppam block, a rural population of Vellore and found a 76% anemia prevalence in 1990. RUHSA (Rural Unit For Health and Social Affairs) Department of Christian Medical College and Hospital, has been providing Maternal Child Care as part of its comprehensive health and development program since 1977, in addition to the national prophylaxis program through Primary Health Centres.

The Mother Care Project, John Snow Inc. USAID had taken on research studies in selected countries to prevent and control anemia among pregnant women. Four projects from India were selected. As part of this multicentric study RUHSA Department of CMCH, Vellore had taken up this experimental study to be carried out having K.V.Kuppam block as intervention block and Gudiyatham blcok as control block between June 1996 - July 1998.

II. IRON, IRON DEFICIENCY AND ANEMIA

IRON METABOLISM

Iron is essential in the production of hemoglobin, which functions in the delivery of oxygen from the lungs to body tissues, in electron transport in cells, and in the synthesis of iron enzymes that are required to use oxygen for the production of cellular energy (Bothwell et al 1979; CEC 1993).

Iron balance is determined by the body's iron stores, iron absorbtion, and iron loss. At least two thirds of body iron is functional iron, mostly hemoglobin within circulating red blood cells, with some as myoglobin in muscle cells and parts of iron containing enzymes. Most of the remaining body iron is storage iron in the forms of ferritin and hemosiderin, stored in the reticuloendothelial system that serves as a deposit to be mobilized when needed. Adult men have about one third of their total body iron as storage iron, whereas women have a much lower proportion (YIP et al, 1996a) because of menstrual blood loss in non pregnant women and the requirements for fetal and maternal tissue development in pregnant women.

Estimates of total iron needs vary from 660 mg to 1640 mg. Median total iron needs during pregnancy are 840 mg. Iron requirements during the last 6 months of pregnancy amounts to 4.6 mg/day if no iron from the iron reserves are to be used.

Absorption of iron is determined by the presence of heme and non heme iron in the food. Heme iron is well absorbed and is not affected by the composition of the diet. Absorption of non heme iron is dependent on the prevalence of iron inhibitors such as tannates and phosphates or based on the presence of iron enhancers such as ascorbate and meat. The maximum amount of iron that can be absorbed from an adequate diet by anemic adults with iron deficiency is about 3.5 mg/day.

Absorption of iron takes place with ferrous form in the stomach and duodenum. Inside the mucosal cells it combines with apoferritin to form ferritin. To enter the plasma the ferric iron is again reduced to ferrous iron. In the plasma, the ferrous iron is again converted into ferric iron and combines with transferrin or siderophilin. Only reticulocytes can access this to form hemoglobin. The free ferric iron in the serum can be utilized by either the reticulocytes or mature RBCs to form hemoglobin.

The level of iron in the plasma is based on a balance between breakdown of Hb, uptake from the bone marrow for RBC synthesis, removal and storage by the tissues, rate of formation and decomposition and siderophilin or transferrin and absorption from the GI tract. Approximately 27 mg of iron is used by the body each day. Of this 20 mg comes from the breakdown of RBCs, a very small amount from newly absorbed iron and the rest from iron stores. (Viteri F, 1997. Cook DJ et al 1968, Harper HA. 1971)

There are three main stages in the reduction of body iron. Iron Depletion is a decrease of iron stores, measured by a reduction in serum ferritin concentration. Iron-Deficient erythropoiesis develops only in the second stage when storage iron is

depleted and iron absorption is insufficient to counteract the amount lost from the body through feces, desquamated mucosal and skin cells and menstrual blood loss among women. At this time, hemoglobin synthesis starts to become impaired and Hb concentrations fall.

IRON DEFICIENCY ANEMIA is the most severe degree of iron deficiency and ensues if the hemoglobin concentration falls below a statistically defined threshold lying at two standard deviation below the median of a healthy population of the same age, sex and stage of pregnancy. (WHO / UNICEF / UNU 1996). By this stage, the restriction in hemoglobin production is severe enough to lead to the distortion of red cells, with microcytosis and hypochromia. For every case of iron - deficiency anemia found in a population, there are thought to be at least two cases of iron deficiency (YIP, 1994; WHO/ UNICEF / UNU 1996).

ASSESSING IRON STATUS

In developing countries where the problem of iron deficiency is invariably most pronounced, the most common method for assessing iron status is through the measurement of hemoglobin (Hb) or hematocrit (Hct) levels, as a measure of anemia. Although anemia is not a specific indication of iron deficiency, a population with a high prevalence of anemia is likely to have a high prevalence of iron deficiency (YIP et al 1996b). The usual way to find out whether anemia is a result of iron deficiency is to monitor Hb or Hct response to oral iron supplementation (Hallberg et al 1993). A Hb increase of one g/dl after 1-2 months supplementation is diagnostic of iron deficiency (WHO 1968). Hb distribution varies with age, sex and different stages of pregnancy, and with altitude and smoking (CDC 1989) and is possibly genetically determined (Perry et al 1992).

The measurement of iron intake through dietary assessment is only useful as a complement to,not a substitute for, the direct measurement of hemoglobin concentrations, because iron intake and iron nutritional status are usually poorly correlated when bioavailability and host factors are not accounted for.

Serum Ferritin is the most specific biochemical test indicating total body iron stores and is an useful indicator of iron status where prevalence of iron deficiency anemia is low. Cook et al (1994) observed that a combination of hemoglobin, serum ferritin and transferrin receptor concentrations may prove to be the best indicator of iron status in pregnancy. Serum ferritin which is a reliable indicator of the iron stores in the first trimester, becomes less reliable after the 20th week due to the physiological dilution of the plasma and a concurrent fall in hemoglobin and serum ferritin. Even if serum ferritin is influenced by the plasma dilution, a concentration below 15 micrograms per litre indicates iron deficiency in all stages of pregnancy. (Haram, 1997)

Iron deficiency and iron deficiency anemia are the most prevalent nutrient deficiency problems during pregnancy, and these conditions are more common among pregnant women than in any other population groups.

DEFINITION OF ANEMIA AND IDA

Anemia is a condition of low circulating hemoglobin (Hb) with serious and life-threatening consequences (Gillespie 1998). Anemia is actually a statistical construct. It is defined with respect to an individual, as a state in which the Hb concentration has fallen below a threshold lying at two standard deviation below the median of a healthy population of the same age, sex and stage of pregnancy.

In a community in which there is no anemia, the frequency distribution curve of hemoglobin concentration follows a nearly normal or Gaussian distribution, but in a community with a high prevalence of anemia, the frequency distribution curve will be skewed to the left. If the distribution of values is truly Gaussian, the frequency distribution can be accurately characterised by the mean and standard deviation of the mean. However when anemia is present, the frequency distribution may depart from the Gaussian form and the mean and standard deviation do not precisely define the situation. Anemia is diagnosed by measuring the levels of hemoglobin in blood.

Table: Hb level below which anemia is judged to be present

Group/Age/Physiologic Status	g/dl
Children 6 Months to 5 Years	11.0
Children 5 - 11 Years	11.5
Children 12 - 13 Years	12.0
Non pregnant women	12.0
Pregnant women	11.0
Men	13.0

Source : WHO/UNICEF/UNU (1996); Adopted from WHO(1968).

In the developing world much of the anemia is caused by iron deficiency. Therefore it is necessary to test for iron and determine levels of iron deficiency (ID). Serum Ferritin is the most accepted test for iron deficiency. The cut off used for iron deficiency is <12µg/L of serum ferritin. Using both hemoglobin cut offs and serum ferritin cut offs different levels of iron depletion and anemia can be estimated (Cook & Skikne 1989). These are:

Categories	Serum Ferritin	Haemoglobin	Diagnosis
Category I	> 12 µg/L	>11g/dl	Normal, ID excluded
Category II	< 12 µg/L	>11g/dl	Storage Iron Depletion
Category III	< 12 µg/L	<11g/dl	IDA
Category IV	> 12 µg/L	<11g/dl	Other Causes of anemia

While there has been universal agreement on the cut off for anemia using hemoglobin, there are differing opinions relating to serum ferritin level. The generally accepted cut off is <12μg/L of Serum Ferritin. Some have 15, 16, 20 etc as cut offs.

Further there is also general acceptance that it would be better to use at least one or two other indicators to assess iron deficiency. The suggested ones are transferrin saturation <16%, erythrocyte protoporphyrin >70 μg/dl RBC. In this study these tests were not carried out. Therefore only Hb and serum ferritin have been used to define iron deficiency anemia.

PREVALENCE OF ANEMIA

a. Iron Deficiency Anemia:

The first problem encountered in assessing the magnitude of the problem, globally, regionally or nationally, is the general paucity of data on anemia. The prevalence data by countries that do exist, moreover, are often confined to pregnant women, who are likely to be the group most at risk, but not the only one.

The total prevalence is estimated at about 40% of the world's population (WHO 1991). Prevalences among sub groups are 51% for pregnant women, 48% for infants and 1 - 2 year old children, 35% for non pregnant women and 25% for preschool children. These are global mean estimates. Prevalences in all these sub groups tend to be upto 3 to 4 times higher in developing than developed countries (WHO 1991). Anemia affects an average of 43% of non pregnant women in the developing countries and 12% in the developed countries (WHO, 1992). The prevalence among pregnant women in developed countries is, but still substantial, averaging 18% (WHO 1992). In developing countries, the prevalence of anaemia in pregnancy averages 56% ranging between 35% and 75% among different regions of the world (WHO 1992).

The following table presents the ranked prevalence of anemia (Hb <11 g/dl) for pregnant women, derived from a total of 32 existing national level surveys available globally (WHO,1992).

TABLE: MAGNITUDE OF THE PROBLEM OF IDA GLOBALLY

Region	No. of Countries		Prevalence
	Total	Included	Hb<11 g/dl
South East Asia	11	3	79%
Eastern Mediterranean	22	14	61%
Africa	46	14	44%
Western Pacific	26	3	39%
Americas	36	3	29%
Europe	50	4	20%

In Central Asia, very high prevalence of 80% and 60% among women and children respectively have recently been reported in demographic and health surveys in Kazakhstan and Uzbekistan.

TABLE: MAGNITUDE OF THE PROBLEM OF IDA - SOUTHEAST ASIAN COUNTRIES

South East Asian Countries	Prevalence Hb <11g/dl
Bangladesh	77 (1981-82)
India	60
Indonesia	63
Maldives	68 (Recent)
Myanmar	52
Nepal	68
Srilanka	58
Thailand	16

Nearly half of the global total number of anemic women live in the Indian subcontinent (WHO, 1991). In India alone, prevalence of anemia among pregnant women may be as high as 88% (ICMR 1989).

ADOLESCENTS:

In a multi country study on nutritional status of adolescents carried out by the International Centre for Research of Women, anemia was found to be the most widespread nutritional problem and highly prevalent in four of the six studies in which it was assessed. Prevalences ranged from 32 - 55% (Kurz and Johnson - Welch 1994). There was no gender difference in three of four studies in which it could be assessed, whereas in the fourth, more boys than girls were anemic. Based on the few data available at that time on anemia during adolescence, De Maeyer and Adiels - Tegman (1985) had earlier estimated the mean prevalence in developing countries at 27% with no gender difference.

A classification of countries with respect to the degree of public - health significance of anemia has been proposed (WHO / UNICEF / UNU 1996). Countries or population groups with anemia prevalence of at least 40% are categorised as `High', 15-40% as `Medium' and under 15% as `Low'. These rates apply to all age and physiological groups.

IRON DEFICIENCY

The prevalence of iron deficiency, which precedes anemia is much higher. Even in industrialized countries in the absence of iron supplementation average serum ferritin concentrations in late pregnancy falls into the deficient range.

CAUSES

a. Diet:

The iron status of an individual is viewed here as a central box, being determined by the way in which a combination of `in' and `out' factors relate to that person's particular requirement for absorbed iron. The latter is related to various factors such as age, gender, physiologic status, and pre existing iron stores. `In' factors include the form of dietary iron (heme or non heme) and the concentration of various dietary constituents that either inhibit or enhance the absorption of dietary iron consumed (Macphail and Bothwell 1992). Fortification of iron and iron supplements where they exist, are other `In' factors. `Out' factors on the other hand essentially refer to losses of body iron through blood loss which may be pathologic (eg. intestinal helminth infection)or physiologic (eg. menstruation, pregnancy and blood loss during delivery).

`IN' FACTORS	DETERMINANTS OF NEED FOR ABSORBED IRON	`OUT' FACTORS
Dietary Iron (heme or nonheme)		
Inhibitors		Physiologic Factors
* Tannins * Phytates * Calcium * etc	Age Birth Weight Growth Demand Pregnancy Demand	* Basal losses * Menstruation * Child birth
Enhancers	Existing iron stores	Pathological blood losses
* Ascorbic Acid		* Intestinal helminths
* Meat		* Allergies
Fortification Iron Iron Supplementation		* Gut diseases

b. Folate:

Folate deficiency, which occurs when absorbed folate does not meet requirements over time, may lead to anemia (Fleming and Werblinska (1982), increased susceptibility to infections (Brabin 1982), low birth weight (Scholl et al 1996), neural tube defects (Rosenberg 1992) delayed growth in early childhood and adolescence (Harrison et al 1985) and delayed sexual development (Watson - Williams 1962).

An individual may become folate depleted as a consequence of a folate- deficient diet, often seasonal, or from malabsorption following systemic infections or tropical sprue. Pregnancy and lactation exert a particularly high demand for folate. Tissue folate stores may be depleted in up to one-third of pregnant women worldwide (FAO/WHO 1970) and prevalence may be particularly high in Africa and Asia (Fleming 1989, Baker 1981).

Seasonality is also an important issue with respect to anemia prevalence. A twofold increase in anemia prevalence was seen in school children in Mali, from 30% in April to 58% in October (Diallo 1997).

c. Intestinal helminths:

Hookworms are intestinal helminths which can contribute to anemia. Hookworms cause intestinal blood loss by feeding on blood through the intestinal mucosa. Chronic fecal blood loss due to hookworm infection is a significant contributor to anemia (particularly, moderate and severe anemia) among certain populations (Roche and Layrisse 1966; Srinivasan et al 1987, Stoltzfus et al 1997).

Where hookworms are prevalent, hookworm control is a feasible and essential component of anemia control. Regarding the relative efficacy of different drugs in reducing hookworm infection, meta analysis has confirmed that albendazole is more effective than mebendazole. No difference was found in the frequency of side effects between the two drugs. Deworming should be carried out among pregnant women after the first trimester when there is no risk of teratogenicity (WHO 1994). Deworming of pregnant plantation workers in Sri Lanka has been found to increase the beneficial effects of iron supplementation on hemoglobin concentration and iron status significantly (Atukorala et al 1994).

CONSEQUENCES

a. Maternal Mortality Risk:

Anemia is a major contributory cause of postpartum maternal mortality and may shift a pregnant women's balance towards death during delivery (Koblinsky 1995). A recent review of 21 studies in Africa and Asia (Ross and Thomas 1996) concluded that a reasonable estimate of the risk of maternal mortality attributable to anemia is 20% in Africa and 22.6% in Asia. It is not only severely anemic women who are at risk of dying during child birth. Maternal mortality risk has been seen to decrease as hemoglobin levels increase (Harrison 1982). The attributable mortality due to severe anemia was 31%, with severely anemic women having an 8.2 increased odds of mortality than non anemic women (Zucker et al 1994). In a study of the effect of anemia on surgical mortality in the USA, a similar relationship was found, and even mild anemia was associated with some increase in mortality risk (Carson et al 1996).

b. Fetal Growth Retardation and Prenatal and Perinatal Mortality:

Anemia is directly related to risk of preterm delivery, inadequate gestational weight gain, and increased perinatal mortality (Mac Gregor 1963; Garn et al 1981, Murphy et al 1986; Worthington - Roberts 1990; Scholl et al 1992). The more severe the anemia the greater is the risk that the mother will deliver a low birth weight baby because of poor intra uterine growth.

FACTORS:

Anemia is influenced by a wide variety of factors. Many of the studies reviewed appear to have examined the factors influencing anemia not as a primary objective but rather as background variables. This handicaps one to make definitive statements on the determinants of anemia. Although socio-economic factors are known to influence anemia among pregnant women, the limiting factor in many of the studies is that they have classified families into high and low socio-economic groups using one or two variables such as income, occupation and education.

Income is a good indicator of socio-economic status nevertheless, there are several problems in assessing the income of families. In a country setting like India where agriculture is the main occupation, measuring their income earned through farm production becomes difficult. The reason is much of the farm produce (such as rice, ragi and groundnut) is kept for consumption. Other farm products like vegetables and fruits are sold in the market. When asked, people do not count in their income that which is consumed. Secondly, the majority of them do not reveal their actual income from the farm produce. Many of the farmers also have cows and they consume and sell the milk. Again this is also excluded from income. Hence income becomes a difficult measure of socio-economic status. On the contrary occupation and education information can be easily and accurately obtained. However education and occupation by itself cannot speak for the socio economic status of a family. These are sometimes masked by other variables of socio-economic status. A family's ethnic background (caste in India), type and size of family, housing quality and land holding are all indicators of socio-economic status. Inclusion of these variables will provide us with a clearer picture of the socio-economic status of the subject investigated.

Secondly, anemia is also influenced by obstetric factors. Many studies have taken parity as the key obstetric variable influencing anemia during pregnancy. Although this is an obstetric risk factor for anemia during pregnancy it does not take into account pregnancies that were lost due to abortions. Hence, it is important to examine the relationship of number of pregnancies (gravida) and anemia. Also needed are studies that examine the influence of early marriage, early conception, age at menarche, abortions, still births and pregnancy spacing on anemia during pregnancy. Currently there is very little information available on how the above factors influence anemia during pregnancy.

A conclusion of this review is that there is no study available that has examined the effect of both socio-economic and obstetric factors together on anemia during pregnancy. By doing so we can demonstrate which has more influence on anemia; whether it is socio-economic status alone, or obstetric factors, or both.

Finally there are issues of whether pregnant women are aware of anemia and whether they utilize the iron and folic acid supplementation program. While this is an important aspect of an anemia control program this has not been adequately researched. The knowledge, attitude and practice of women on anemia has a direct bearing on the hemoglobin status. If pregnant women are aware of the causes, consequences and prevention of anemia they may utilize and comply with IFA treatment. If these views hold good, addressing the problems of anemia during pregnancy by IEC campaign is the preferred strategy. For planning an IEC strategy one has to have prior information on the existing knowledge, beliefs and practices pertaining to anemia during pregnancy. Intervening without obtaining this may have only a limited effect.

III. MOTHER CARE ROLE-MULTICENTRIC RESEARCH

In Mother Care II (1993-1998), to address the problem of anemia at a global level Mother Care Project, John Snow, Inc. funded by the United States Agency for International Development (USAID), USA had taken on research work in different countries of the world: Bolivia, Guatemala, Indonesia, Malawi and India. In India, proposals were accepted from four different institutions to research on the control of maternal anemia. The following are the 4 centers: 1.The Baroda Citizens Council, Baroda, Gujarat. 2.SWACH (Survival for Women and Children Foundations), Chandigarh, Haryana. 3.RUHSA Department of Christian Medical College and Hospital, Vellore, Tamil Nadu. 4.St. John Medical College, Bangalore, Karnataka. (Mother care 1996).

Mother Care Project organised a qualitative research workshop at Baroda to fine tune all the 4 projects to investigate and quantify the problems of anemia in their respective areas. Mother Care also arranged a consultancy by Dr. Subodha Kannani while applying the qualitative methods in the field. Mother Care also funded for one person from each project to attend the "International Nutrition Conference", Montreal, Canada by having a preliminary preparation session at Washington, DC USA in the year 1997. Mother Care again motivated and funded one person from each project to attend the International Conference on "Reproductive Health" held in Bombay, India. Mother Care monitored the project implementation through the regular progress reports once in 3 months. A 3 day workshop was organized to make the final project report presentation at Bangalore (21st - 23rd Aug, 1998). A cross site project visit was permitted to share the experiences amongst the 4 projects in India. In this context 3 personnel from RUHSA visited SWACH at Chandigarh and benefited.

The materials for the implementation of the project obtained were a IBM 586 Multi Media Computer with a printer and four Motor Cycles. Though the project `A programme to prevent and control anemia' was intended for 2 years from June 1996 - June 1998 the implementation was effective only for 18 months. The qualitative research, baseline quantitative survey, planning and preparation for intervention strategies and post evaluation consumed the rest of the time. Despite this, a significant achievement was made.

IV. BRIEF DESCRIPTION OF RESEARCH AREA

RUHSA is a Department of the Christian Medical College and Hospital, Vellore and has been carrying out comprehensive rural health and development work since 1977. K.V.Kuppam Block extends over an area of 150 Sq.Km. with 39 rural Panchayats. Each Panchayat has an average population of 3000 with a total population of over 110,000 (Abel et al, 1992). Agriculture is the predominant occupation.

This block is served effectively both by RUHSA Department of CMCH and the Government. RUHSA has a 60 bed secondary health centre catering to about 1200 deliveries each year. In addition to family planning and outpatients service, cases requiring additional inputs are referred to the tertiary centre of CMCH, Vellore, 25 Kms away. This secondary health centre supports a very wide Primary Health Care Program. Four mobile teams consisting of a doctor and a nurse each, conduct 16 mobile clinics each week at fixed location and time. There are 4 PHCs of the Government each covering a population of over 25,000. In addition, the community uses the hospitals and private practitioners of the nearby towns. RUHSA also provides regular immunization for children and antenatal care for pregnant women. In addition to health care delivery family planning services formed an important component. In a cafeteria approach with major services available, women chose tubectomy almost exclusively with a few receiving IUDs. Increasing the awareness of women on health related issues was another major input. Initially it started with oral rehydration in diarrhoea, then moved on to nutrition education and more recently, AIDS awareness.

Along with health inputs socio economic development formed another major component. RUHSA had a direct bearing on improving the food security by making more food available as milk, eggs and poultry and increasing purchasing power by increasing opportunities for labour and self employed business. Adult education was another major activity. The specific activities are: Banking schemes, Adult Education, Community Education, Mobile Library, School Health, Vocational Training, Women's Development, Energy Programs, Relief and Development, Welfare and Rehabilitation, Primary Veterinary Care, Cattle Cross Breeding Program, Goat Cross Breeding Program, Community Broiler Schemes, Social Forestry, Watershed Management, Sericulture, Credit Union, Health Education, Adolescent Girls Program, Program for the Poorest of the Poor, Bio-diversity etc.

Research has received emphasis right from RUHSA's inception. Polio control using killed polio vaccine was the first major trial. This was followed by another major study on chronic obstructive pulmonary diseases. Severe acute respiratory infection was another major research activity. Nutrition research has received the widest support. The first doctoral work was on Basal Metabolic Rate and body size. The research on growth monitoring conclusively proved that weighing by itself did not have any beneficial effect. This formed the second Ph.D study. The third Ph.D study identified that Vitamin A supplementation did not have any effect on morbidity and growth. The next Ph.D work was on Social Indicators of Health Status. The fifth Ph.D work studied the socio demographic determinants of maternal and child nutrition. The sixth and seventh current studies are on Leprosy and Nutrition, and Leprosy and Fertility respectively. Besides these, a number of smaller studies have been carried out.

V. OBJECTIVES

The objectives of this study are classified into four categories. The first is the overall program objectives, followed by qualitative research objectives, baseline survey objectives and finally evaluation objectives.

A. PROGRAM OBJECTIVES

1. To reduce the prevalence of iron deficiency anemia (Hb<11 g/dl) among pregnant women by 15% over 2 years by:
   a. Ensuring that at least 80% of all pregnant women consume at least 80 tablets of iron and folic acid pills (IFA).
   b. Promoting early consumption of IFA pills among pregnant women by ensuring at least 75% enrollment into antenatal care in the first trimester and 90% in the second trimester.
   c. Promoting awareness of anemia and its prevention using Information, Education and Communication (IEC) strategies.
   d. Providing routine deworming during second and third trimesters to reduce the prevalence of hookworm.(Mebendazole 100 mg twice a day for 3 days).

2. To reduce the prevalence of iron deficiency anemia in adolescent and newly married girls by 25% over 2 years by:
   a. Promoting consumption of IFA tablets (same regimen as for pregnant women)
   b. Decreasing the prevalence of hookworm infection by 50% (Mebendazole 100 mg twice a day for 3 days).

B. QUALITATIVE RESEARCH OBJECTIVES

1. To obtain the community based perception about maternal problems and their association with anemia.
2. To explore indepth information on the cultural based perception of rural pregnant women regarding maternal anemia, its causes, signs and symptoms, consequences, prevention and treatment.
3. To obtain culturally held beliefs and practices of rural pregnant women regarding maternal anemia, IFA consumption pattern and diet during pregnancy from health care providers of the Government and NGO. Furthermore, to seek their views on the desired treatment seeking behavior (as advised) VS. the actual treatment seeking behavior as adopted by them.
4. To document the health seeking behavior of rural pregnant women on anemia.
5. To document the treatment practices of traditional healers and medical officers of Government and NGO for anemia during pregnancy.
6. To elicit the level of awareness and perceptions of pregnant women and health care providers regarding the Government and NGO iron folate supplementation program and IEC of anemia.
7. To obtain the perceptions on hot foods and cold foods during pregnancy and foods that are consumed and avoided during pregnancy including the utilization of locally available iron rich foods.

8. To obtain the perceptions of adolescents girls on anemia and menstruation, anemia and physical growth, anemia and physical activity, anemia and pregnancy.
9. To use this data to evolve a health education strategy for pregnant women and adolescent girls to prevent and control anemia among pregnant women.

C. PRE INTERVENTION OBJECTIVES

1. To Determine the prevalence of anemia and iron deficiency (ID) among pregnant women.
2. To examine whether anemia and ID is correlated with the following socio demographic economic and obstetric variables:

a) Socio Demographic and Economic	b) Obstetric
Caste, Type of roof Family size, availability of Latrine Type of Family Education, Occupation Age at Marriage Age at Menarche	Age at 1st Pregnancy Gravida, Parity, No. of living children, Spacing, Still birth, Abortions, Chronic malnutrition.

3. To examine the utility of clinical signs and symptoms in screening anemia.
4. To assess the knowledge, attitude and practice of pregnant women on the following aspects of anemia.

Knowledge	**Attitude**	**Practice**
- Signs & Symptoms - Causes, Consequences. - IFA procurement, advantage, duration Side effects. - Hook worm infestation - Food Habits	- IFA & Health during pregnancy - IFA & Health of the baby - Importance of preventing anemia. - Need to consume IFA. - Increased diet need.	- Diet during pregnancy - ANC Care - IFA supplementation (Dosage, duration, side effects, sources, storage, counselling)

D. POST INTERVENTION OBJECTIVES

1. To assess the achievement of the program objectives

   a.. To measure the decrease in the prevalence of anemia and iron deficiency among pregnant women and adolescents.
   b. To estimate the shift in the early enrollment into antenatal care and early IFA consumption.
   c. To determine the increase in knowledge, attitude and practice of anemia related facts among pregnant women and adolescents.
   d. To find out the decrease in the prevalence of hookworm infection.

2. To assess the effectiveness of the interventions carried out in the study block.

VI. METHODOLOGY

A. LARGER STUDY METHODS:

1. THREE PHASES OF THE PROJECT:

a. A baseline phase was carried out by undertaking, Qualitative Survey in the intervention area and Quantitative baseline surveys in the intervention and control area.

Qualitative Survey i. Perceptions among pregnant women adolescent girls and health care providers regarding anemia in pregnancy and in adolescents

Quantitative Survey i. Prevalence of anemia and iron deficiency among pregnant women and adolescents ii. Hookworm presence iii. Knowledge and practice of pregnant women and adolescents about anemia, IFA procurement and consumption, hook worm infestation and iv. Risk factors for anemia.

b. An Intervention phase that included the development of Information, Education and Communication (IEC) materials that were used in training health professionals, Community Volunteers and the community. Training was provided to all health care providers of Government and RUHSA. Different communication strategies were used to disseminate the facts of anemia by educating pregnant women, adolescents and the community. Different procedures were devised for the procurement and consumption of IFA and deworming. Systematic monitoring procedures were adopted.

c. An evaluation phase to determine the process outputs and outcomes. This included only the quantitative survey to estimate the increase in the knowledge, practices related to anemia, hemoglobin concentration, serum ferritin concentration and presence of hookworm ova in the stools.

2. RESEARCH DESIGN

The anemia intervention study composed of a two group pre - post experimental design to measure the effectiveness of iron supplementation, deworming and IEC implemented in K.V.Kuppam block. Gudiyatham block which is similar to K.V.Kuppam block served as the control.

PHASE	Study Block K.V.Kuppam	Control Block Gudiyatham
I Pre Intervention survey June, July, 96	Yes	Yes
II Intervention	With Intervention - For Pregnant Women a. IEC, b. IFA c. Mebendazole - Adolescent Girls a. IEC	No Intervention
III Post Intervention survey July, Aug 98	Yes	Yes

The baseline and post evaluation surveys were carried out as part of this experimental anemia intervention study. In this experimental study we had two geographical areas serving as experimental and control areas. These areas are located in Vellore District, Tamilnadu state of Southern India. Tamilnadu lies in the southern most part of India. There are 21 districts and it has a population of over 55.6 million. The topography of Tamilnadu consists of the coastal plains in the east with upland and hills in the west. The state is largely dependent on rainfall for replenishing its sources of water and therefore the onset or failure of the monsoon plays a key role in its economic well being. The birth rate of rural Tamilnadu is 20.1 per 1000 in 1996 while the infant mortality rate is 60 per 1000 in 1996 (Bulletin, 1997). Vellore district is considered to be a backward region in Tamilnadu.

K.V.Kuppam block was selected as the experimental area and Gudiyatham block as the control area. K.V.Kuppam block was selected because it is the operational area of RUHSA Department of Christian Medical College and Hospital. Gudiyatham block was selected as the control area because it matches with K.V.Kuppam block in terms of socio-economic and geographical characteristics.

Apart from RUHSA in K.V.Kuppam block the Government Primary Health Care program and Tamil Nadu Integrated Nutrition Program (TINP) supplies iron and folic acid tablets to pregnant women. Private clinics and hospitals are almost negligible in number. There are no NGOs that emphasize health care in Gudiyatham block. Only the Government Primary Health Care program and TINP carry out Health and Nutrition intervention. Iron and folic acid tablets are supplied to pregnant women by these two programs.

3. ETHICAL ISSUES

The entire research was approved by the Research Committee of the Christian Medical College, Vellore. In particular a question relating to the administration of mebandazole to pregnant women was raised. The proposal was approved with the understanding that deworming would be done only during the second or third trimester of pregnancy.

Informed consent was obtained verbally from all respondents. They had freedom to either participate or not participate in the study and also to withdraw from the study at anytime. Basically participation involved answering an interview schedule, and providing blood for hemoglobin and/or serum ferritin. In the study area they were also to be involved in iron supplementation, deworming and the health education program purely voluntarily.

Among pregnant women during pre intervention survey only 5 women from the control area refused to participate right from the interview stage. Of those interviewed, 13 from the study area and 20 from the Control area refused to give blood. One adolescent girl refused to participate at the interview stage. Ten girls from the study area and 16 girls from the control area refused to give blood.

It was built within the study to provide medical support to anyone identified with very abnormal hemoglobin and/or serum ferritin levels. One woman had serum ferritin 573 µg/L and she was followed up separately. While individual respondents were not compensated monetarily, those pregnant women desirous of utilizing the delivery service of the institution were ensured subsidized care both at the secondary level and at the tertiary level when needed.

B. BASELINE QUALITATIVE STUDY

The qualitative methods followed are given in the following table:

S.NO.	QR/PR METHODS	TYPE OF INFORMANTS	TIMES METHOD ADOPTED	NO. OF INFOR-MANTS	AGENCY
1.	KEY INFORMANT INTERVIEW (KII)	Doctor	1	1	GOVT.
		Doctor	1	1	RUHSA
2.	FOCUS GROUP DICUSSION (FGD)	Pregnant Women	6	50	COMMUNITY
		Adolescent Girls	4	42	COMMUNITY
		Family Care Volunteers(FCV)	1	6	RUHSA
		Health Aides (HA)	1	8	RUHSA
		Rural Community Officers (RCO)	1	7	RUHSA
		Nurses	1	7	RUHSA
		Village Health Nurses (VHN)			
		Sector Health Nurse (SHN)	1	8	GOVT.
3.	FREE LISTING & PREFERENCE RANKING	Health Aides	3	8	RUHSA
		VHNs, SHN	3	8	GOVT.
4.	SEASONA LITY ANALYSIS	Farmers & Pregnant Women	4	15	COMMUNITY
		Only Pregnant Women	2	16	"
5.	INDEPTH INTERVIEW	Farmer	1	4	"
6.	NARRATIVE	Pregnant women with Hb <7 gm	2	2	"
		Adolescent Girls	1	1	"
7.	SCENARIO	Trained Dai	1	1	"
		Traditional Healer	1	1	"
8.	FREELIST	Adolescent Girls (Educated)	2	29	"
9.	TRIAD	Adolescent Girls (Uneducated)	2	13	"

Two of the personnel attended the Qualitative Research methodology workshop conducted by Mother Care at Baroda in November 1996. A draft plan was prepared and presented in the workshop to initiate the research prior to the intervention to control anemia. The objectives framed, methodology followed, the findings arrived based on the research and the applications of the qualitative findings in the intervention part of the program is prepared as a separate report. The findings of the qualitative research helped to evolve the health education messages with appropriate words. Also it helped in the formulation of baseline questionnaire for the quantitative survey for adolescents and for the subsequent post evaluation surveys for both the groups.

C. PRE AND POST INTERVENTION QUANTITATIVE SURVEYS

1. SAMPLING METHODS:

a. Pregnant Women:

The first stage in identifying a representative sample of households with pregnant women consisted of selecting panchayats (Government administrative units) from each block. Each block is divided into panchayats which are spatially defined sublocations within their respective communities. K.V.Kuppam block has 39 panchayats while Gudiyatham block has 44 panchayats. The population details of K.V.Kuppam block were obtained from the profile developed by RUHSA Department (Abel, 1992). Similarly the population details of Gudiyatham block were obtained from the Government Block Development Office, Gudiyatham. Based on the required sample size the number of panchayats selected was 20 from each block. Simple random sampling was adopted to select 20 panchayats from Gudiyatham block and systematic sampling was used for the selection of 20 panchayats from K.V.Kuppam block. The list of panchayats of Gudiyatham Block was arranged in alphabetical order and therefore simple random sampling technique was used to have a representative sample. On the other hand, systematic sampling technique was used for K.V.Kuppam block, as the list of panchayats was arranged in the order of geographical location. As all the panchayats that comes in `2's were selected from the K.V.Kuppam block during pre evaluation, all the `1's were selected during the post evaluation to avoid repeating the same sample. As simple random sampling was decided for the Gudiyatham block, some panchayats were selected in both pre & post evaluation during random selection. All the pregnant women from the selected panchayats of both the blocks were included in this survey. The lists of selected panchayats during pre and post evaluation are presented in the Appendix G.

b. Adolescent Girls:

In the selected areas for pregnant women, alternate panchayats were selected for surveying adolescent girls. Adolescent girls were selected using systematic sampling one for every 7 girls in the selected panchayat. The first girl was chosen by lottery method. In K.V.Kuppam block, the list of adolescents were available. The identification of the girls were made from the list. In Gudiyatham block, every 7th girl was identified by systematically visiting every house. This procedure was adopted during pre evaluation survey. In the post evaluation one for every 5 girls was selected and the number of panchayats was same as that covered for the pregnant women.

2. SAMPLING DESIGN

A multistage cluster approach was adopted to select the samples.

PARTICULARS	PRE INTERVENTION		POST INTERVENTION	
	Study	Control	Study	Control
1. Pregnant women				
a. Sampling Technique	Systematic Sampling	Simple random sampling	Systematic sampling	Simple random sampling
b. Sampling Unit	Panchayat	Panchayat	Panchayat	Panchayat
c. No. of Panchayats	20	20	20	21
d. No. of Subjects				
i. For KAP & socio economic	522	510	409	464
ii. Hb	464	431	403	425
iii. SF	260	211	216	223
e. Survey Tool	Pretested Schedule	Pretested Schedule	Pretested Schedule	Pretested Schedule
2. Adolescent Girls				
a. Sampling Technique				
1st Stage	Systematic Sampling	Simple random sampling	Systematic sampling	Simple random sampling
2nd Stage	One in 7 girls in each panchayat	One in 7 girls in each panchayat	One in 5 girls in each panchayat	One in 5 girls in each panchayat
b. Sampling Unit				
i. 1st stage	Panchayat	Panchayat	Panchayat	Panchayat
ii. 2nd stage	Adol girl	Adol Girl	Adol Girl	Adol Girl
c. No. of Sampled Panchayats	10	10	20	20
d. No. of Subjects				
i. Socio Economic & KAP Survey	155	161	238	273
ii. Hb	141	147	203	239
e. Survey Tool	Pretested Schedule	Pretested Schedule	Pretested Schedule	Pretested Schedule

3. SAMPLE SIZE CALCULATION:

The sample size calculation for the baseline survey was based on the experimental study of carrying out an anemia intervention program. To detect a significant decrease of 25% in the prevalence of anemia and accounting for cluster effects, the sample size was calculated as 500 for each block using an appropriate formula. It was decided that serum ferritin will be measured only for a 50% subsample of 250 mothers in each block. Using the lottery method it was decided that the first sample will be measured for both serum ferritin and hemoglobin and the second sample for only hemoglobin. Serum ferritin was not assessed for the adolescent girls.

4. SURVEY PROCEDURES:

a. Designing and finalisation of survey schedule

Survey schedules provided the bulk of the quantitative information on social, economic, obstetric risk factors as well as on the knowledge, attitude and practice on maternal anemia. In addition, clinical examination, anthropometric and hematological measurements also formed part of this schedule. Specifically the survey schedule had seven parts.

The survey schedule for pregnant women was developed and circulated to experts for comments. The comments were incorporated into the schedule. The draft survey schedule was pretested in one of the panchayats that was not in the selected list of panchayats for the study. Around 50 pregnant women were interviewed in this pre testing of schedules. The purpose of the pre testing was to test the schedules reliability and to see how well it was understood by the pregnant women. The pretesting helped to determine the duration of the interview and led to the reorganization of some of the questions within the schedule. This was carried out before the pre intervention survey. Modification was done with omission of certain variables during post intervention survey (details given in the later section). In the post intervention schedule, a section with six questions was included to be administered in the study block only. The intention of this was to assess the effectiveness of the IEC during intervention.

The same validation procedure mentioned above was also carried out for the adolescent girls. Since the adolescent girls schedule was prepared after the qualitative survey, more easily understood questions were incorporated to elicit their knowledge.

b. Training of Field Workers

During pre evaluation a two day training on survey procedures was carried out for 6 field workers. This comprised class room and field training. In the class room, training was given on schedules, anthropometric procedures and clinical signs and symptoms of anemia. The training on interview schedule was provided by the investigator. Training on anthropometric procedures was provided by the investigator and two other staff who are specialized in anthropometry. Demonstrations were carried out in the class. The field workers were also asked to practice the different anthropometric procedures untill they were standardized.

A medical doctor carried out the training on clinical signs and symptoms of anemia. The field workers were taken to the hospital to see patients with clinical signs and symptoms of anemia. Two patients who had pallor in their conjuctiva, tongue, nail beds and cheeks were observed. On the second day the field workers were taken to the field for training. They interviewed pregnant women, carried out anthropometric measurements and observed for clinical signs and symptoms of anemia. The investigator carried out this training in the field. All the field workers were observed individually on the technique of interviewing, understanding of questions, anthropometric measurements and recognition of clinical signs and symptoms of anemia.

In the post evaluation survey 4 male field workers and 2 computer entry persons were recruited along with the 2 existing field staff who were trained earlier. The four field data collectors were trained thoroughly to administer the schedules. They were taught to ask the questions with clarity and to record the answers with uniformity. Three female Health Aides were trained in the same fashion to use the interview schedule prepared for adolescent girls. Training on clinical signs and symptoms and anthropometric measurements were not imparted as those were not intended during post evaluation. Coding of data and computer entry was taught in detail to computer entry personnel. Training on sample coding of the pregnant women's schedule and adolescent girls' schedule was imparted.

C. Data Collection

Prior to the pre and post intervention surveys planning meetings were held to discuss the logistics of the surveys. The health care workers (Family Care Volunteers and Health Aides) of RUHSA were involved in this survey. Their role was to identify all pregnant women in their respective panchayats. In order to ensure full coverage a door to door survey was carried out by the field workers. The survey team consisted of 6 field workers, one lab technician and a supervisor. One of the investigators also accompanied the team to ensure the quality of data. The survey was first carried out in K.V.Kuppam block. Administration of the survey instrument was divided into two visits. In the first visit the schedule was administered and this was followed by clinical screening for anemia and anthropometric measurements. The interview and the measurements lasted an average of 20 minutes. During the second visit, which was done on the following day, blood was drawn from the surveyed pregnant women. A total of 20 panchayats were surveyed in K.V.Kuppam block from 8th July to 19th August 1996. Blood collection for hemoglobin and serum ferritin continued until 25th August 1996. A total of 522 samples were surveyed. Hemoglobin levels was estimated for 464 subjects. Out of these 260 samples were sent for serum ferritin estimation. All pregnant women interviewed were numbered 1 and 2 sequentially by the field workers. All pregnant women numbered 1 had their blood drawn for hemoglobin and serum ferritin. All women numbered 2 had blood drawn only for hemoglobin. In Gudiyatham block the survey was started on 27th August 1996 and it was completed on 30th September 1996. A total of 510 subjects were surveyed. Blood collection for hemoglobin and serum ferritin was continued until 28th November 1996. In Gudiyatham block, blood was drawn from 431 subjects. Out of these 211 samples were sent for serum ferritin estimation.

The adolescents' baseline survey in both the blocks was carried out in June 1997. The same field workers were used during the pre evaluation survey.

The post intervention survey was carried out in Gudiyatham block from 1.7.98 till 25.7.98 and in K.V.Kuppam block it started from 27.7.98 till 21.8.98. A team consisting of 6 male data collectors for pregnant women survey and 3 female data collectors for adolescent girls survey, one supervisor, one assistant Project Officer and one Lab Technician went in a van to each panchayat. The list of pregnant women maintained by the Village Health Nurse (VHN) of government was obtained and a door-to-door survey was done for the identification of all pregnant women and sampled adolescent girls. On the same day, simultaneously the blood was drawn by the lab technician from the interviewed pregnant women and adolescent girls. The same procedure was adopted for Hb and SF testing as it was done during pre evaluation. A total of 409 and 464 pregnant women in K.V.Kuppam and Gudiyatham block respectively were interviewed. Of which 403 and 425 Hb levels and 216 and 223 SF tests were done in K.V.Kuppam and Gudiyatham block respectively.

5. MEASUREMENTS

a. Socio Demographic Economic Obstetric and Nutritional Variables:

This section describes the variables of socio-demographic, economic, obstetric and nutritional factors. Much focus is laid in defining the socio-economic variables. Obstetric variables are more specific.

The following socio-demographic, economic variables were included:

Religion, Caste, Type of Roof, Type of wall, Type of floor, Availability of bathrooms, Availability of latrine, Number of rooms, Place of drawing water, Land holding (wet and dry in acres), Livestock, Type of family, Size of the family, Geographical location, Age, Education, Occupation, Husband's education , husband's occupation, Age at menarche and Age at marriage.

In India, there are a number of castes and subcastes. The Government of India has classified castes into forward caste, backward caste, scheduled caste and scheduled tribe based on their economic status. The scheduled caste belong to the lowest category. In this part of Tamilnadu there are no scheduled tribes. Since many of the caste names have similar suffixes the field workers were instructed to obtain the complete caste name. For instance the Kamma Naidu belong to the forward caste whereas the Balija naidu belong to the backward caste. The suffix of both the caste have a similar name. Similarly there are many castes whose suffixes have the same name.

Type of roof is classified into thatched, tiled and terraced. Terraced roof is an indicator of upper socio-economic status while thatched roof is an indicator of lower socio-economic status. Number of rooms in the house is also an indicator of socio-economic status. Land holding is classified into wet and dry. Wet lands are those which have sufficient water for at least two crops a year. In wet lands, rice, banana, sugarcane and vegetables are grown. Dry lands are those which completely depend on rainfall. They grow only one crop a year which is usually groundnut.

Type of family is classified into nuclear, extended and joint. A nuclear family is one where a husband and wife live with or without their children under one roof and do their own cooking. In an extended family a couple along with or without their children and a relative which could be a parent or brother or sister of either spouse live under one roof. A joint family is one where two couples with or without children live under one roof or separate house but eat food from the same kitchen. Size of the family pertains to the number of members who are currently staying in the house. It excludes children who have gone to work in other towns or cities. Completed years of age was obtained from the subjects. For educational qualification number of completed years of schooling was taken into account. Similarly for occupation the type of work they were engaged was elicited.

The obstetric information obtained was as follows:

Age at first pregnancy, age at current pregnancy, gestational age, gravida, parity, abortions, still births, living children, children died and spacing.

Age at first pregnancy and age at current pregnancy were obtained in completed years. Gestational age was calculated by obtaining the date of their Last Menstrual Period (LMP).

The Nutritional variables measured were:

Height, Weight and Arm Circumference.

b. Clinical Assessment:

Clinical assessment was done on all pregnant women for identifying the signs and symptoms of anemia.

It was done on the following aspects:

Whiteness inside the eyelid (conjuctiva), Pallor in skin, nailbed, tongue, and palms, spoon shaped nails, edema, tiredness, breathlessness, picca and loss of appetite.

Clinical assessment was done by the field workers by observing the sites and by interviewing however it was not validated.

c. Laboratory Tests:

There are several laboratory tests to screen anemia. In this study **hemoglobin** and **serum ferritin** levels were measured. Venous blood was obtained from all pregnant women irrespective of whether only hemoglobin was measured or both serum ferritin and hemoglobin. Venous blood was obtained from the antecubital vein with a disposable syringe and needle after a tourniquet was tied.The area of venipuncture was cleaned with 70% alcohol and it was allowed to dry before inserting the needle into the vein. Blood drawn for hemoglobin was put in EDTA vials with number and name of the subject. Blood drawn for serum ferritin was put into a test tube with anticoagulant. These tubes were supplied by the Clinical Biochemistry Department of CMC&H. Blood was drawn by an experienced trained Laboratory Technician.

d. Hemoglobin Concentration:

Hemoglobin concentration in the circulating blood was analyzed at RUHSA Laboratory. The Cyanmethaemoglobin method was adopted. Twenty micro litre of anticoagulated blood was added to 5 ml of freshly made standared Drabkins solution in a vial to convert hemoglobin into cyanmethaemoglobin. The absorbance of this was measured at 540nm in a photoelectric calorimeter. A hemoglobin level of <11g/dl during pregnancy was diagnosed as anemia.

e. Serum Ferritin:

Venous blood was transferred into test tubes which were delivered to the Clinical Bio-Chemistry Department each day. The serum was separated immediately and stored. Serum ferritin assay which was later carried out in batches. Serum ferritin concentration was estimated by using the kit-coat-a-count Ferritin IRMA from Diagnostic Products Corporation, California. This is an immunoradioactive assay. Coat-a-count-Ferritin IRMA is a solid phase assay, based on monoclonal and polyclonal antiferritin antibodies: A monoclonal antiferritin antibody is immobolized to the walls of a polysterene tube and an 125-I labelled antiferritin polyclonal antibody in liquid procedure:

In the procedure:

i. Ferritin was captured between monoclonal antiferritin antibody immobilized on the inside surface of the polysterene tube and the radiolabelled polyclonal antiferritin tracer.

ii. Unbound 125-I labelled antiferritin antibody was removed by decanting the reaction mixture and washing the tube. This reduces the non-specific binding to a very low level.

iii. The ferritin concentration is directly proportional to the radioactivity present in the tube after the wash step. The radioactivity was measured using a gamma counter, after which the concentration of ferritin in the patient sample was obtained, by comparing the patient counts / minute with those obtained for the set of calibrators provided.

A Bio-rad quality control in duplicate was used for each batch assayed and the results of the particular batch were released only when the control value fell within the given specified range.

f. Anthropometric Measurement Procedures:

Maternal nutritional status was assessed using anthropometric measurements like height, weight and mid arm circumference. The measurements were taken using standard equipment. Through-out the survey the same height measuring rods, weighing scales and measuring tapes were used.

i. Height:

Height of the mothers was measured with the help of a height rod which was specially designed and fabricated as per the recommendations by the Biostatistics Department of the Christian Medical College. The subjects were made to stand erect, barefooted on a level floor with the feet running parallel to each other. After making the subject stand in the position described, the field worker moves to the right side of the subject and places the height measuring rod at the back of the subject in the median sagittal plane of the subject. The height measuring rod has a movable calibrated scale with the flap at the tip. After placing the rod in the appropriate position the field worker moves the scale upside and then places the flap on the vertex of the head. After following all these steps the height was recorded to the nearest centimeter.

ii. Weight

Weight of the mother was measured with the help of a bathroom type of weighing scale (Krupps Model) measuring upto a maximum of 125 kg with increments of 100 gm. The scales were initially calibrated against standard weights. Before each measurement, they were adjusted to read 0.0 kg to ensure accuracy. With slippers removed the mothers were asked to stand erect in the centre of the scale. Care was taken to ensure that the mother did not bend to look at the value as this may cause error.

iii. Mid Upper arm circumference

Mid upper arm circumference of all mothers was measured with the help of the Zerfas Insertion tape supplied by the Voluntary Health Association of India (VHAI). The measurement was taken on the left hand. A point was located at halfway between the posterior tip of the acromion process and the olecranon process. With the arm hanging loosely by the side, the tape was placed around the arm at the midpoint. Care was taken to ensure that there was complete contact of the tape without compressing the underlying fat. The circumference was measured horizontally to the closest 0.1 cm.

g. Knowledge, Attitude and Practice

The knowledge, attitude and practice of pregnant women on anemia was obtained through the interview schedule. The knowledge component had 20 questions covering awareness (definition) of anemia, signs and symptoms, causes, consequences, detection and prevention (diet and IFA). Alternatives were provided for each question and the field workers were instructed not to rush through the question; rather, to provide adequate time for the pregnant women to understand and respond. These questions were asked in a number of ways and sometimes they were prompted. The attitude component was based on a 3 point Likert-type scale and there were 5 items.

The practice component had 13 questions covering ANC registration, consumption of IFA tablet, dosage, duration, side effects, discontinuation and diet during pregnancy such as whether the consumption of food increased or decreased, special foods, foods avoided, dietary advice, consumption of food enhancers and food inhibitors, and finally consumption of meat.

Based on the experience in the pre intervention survey, it was decided to omit some of the following socio economic variables during the post intervention survey : type of wall, type of floor, availability of bath room, place of drawing water, livestock and geographical location. As screening for anemia using clinical signs and symptoms did not help much, screening was not carried out during post evaluation. Assessment of nutritional status using Ht, Wt, AC was not carried out during post evaluation. From the KAP component of the schedule, hot foods, cold foods, reasons for avoiding, practice during previous pregnancy were the variables omitted. All the other measurements were followed as was done in the pre evaluation.

6. QUALITY CONTROL PROCEDURES

Review was held almost every day during the first half of the survey to make sure there was uniformity among the data collectors. Office editing ensured completion and accuracy of data by cross checking the answers provided. (eg. Cross check between age, age at menarche, age at first pregnancy and spacing, discrepancy between gestational age and ANC registration and procurement of IFA).

A 5% sample of blood collected was tested in CMC. The results were compared to see the variations in the results between RUHSA and CMC. This confirmed the reliability of blood test. The variation between RUHSA & CMC was found to be negligible.

7. DATA ANALYSIS PROCEDURES

The first process in the data analysis was editing of survey schedules. Field editing was done on completion of each day's data collection. Editing of completed schedules was done by a supervisor. The next step that was followed was coding of the data. This was done using a coding key. The coded data were computerized in Foxplus package and completely verified. Further the data was edited by examining frequency distributions for missing values and for other errors in tables arising out of wrong data entry.

The following statistical methods were used:

Percentages were calculated for all the variables. Means and standard deviations were calculated wherever appropriate. Correlation analysis was carried out using the Pearson product moment correlation.

A step wise regression analysis was done to determine which of the socioeconomic, obstetric and nutritional status variables hypothesized to influence hemoglobin levels and serum ferritin levels gave statistically significant information. Four regression analyses were conducted. One for each measure of the dependent variables. The models of regression analysis were socio-economic status consisting of religion, caste, roof, cultivable land, family type, family size, geographical location, education, occupation, husband's education and husband's occupation; obstetric variables consisting of mother's age, age at menarche, age at marriage, gravida, parity, abortion, number of living children, number of children died and spacing; nutritional

status comprising of height, weight, arm circumference and Body Mass Index and finally a model consisting of socio-economic, obstetric and nutritional status variables. Computerization was done using the Statistical Package for Social Sciences (SPSS 5.0 version).

During post intervention survey, two computer entry personnel did the office editing of the schedules and coding the data. This process was done every day in the evening. Simultaneously data on pregnant women and adolescent girls were entered into the computer using Foxplus software package. Following this editing also was completed. The person who managed the data developed the programs for analysis. This helped the preliminary data analysis process to come to an end by 24.8.98, two days after the data collection was over. Simultaneously, the draft report under the given outline by MOTHERCARE was completed by 25.8.98 and presented on 28.8.98 at the Bangalore workshop, organized by Mother Care.

Later, further analysis was completed and the report for the entire anemia control program was worked out comparing the baseline evaluation data, post evaluation data and the intervention process and it was made ready by the end of October 1998.

As a result of this program 3 major reports were prepared 1. Baseline Qualitative Report. 2. Baseline Quantitative Report and 3. Anemia Control Project final report. Apart from these there were three reports prepared as it was required by Mother Care and the formats were given by them. a. Provider and client perspectives on anemia b. Formative Research for designing anemia control intervention / experiences in applying qualitative and participatory research methods in India. c. Mother Care II Close out final report.

D. INTERVENTION METHOD

The strategies followed in this project were

1. Early Antenatal Registration and IFA Distribution
2. IEC - Community Based Education Intervention for behaviour change
3. Deworming
4. Monitoring
5. Evaluation

1. Early registration and IFA distribution

a. Early antenatal Registration. Previously pregnant women were registered for antenatal care only in the 5th month. This practice was changed by identifying and recording the pregnant women as early as possible by FCVs and registering positively by 3rd month.

EARLY ANC REGISTRATION

IFA DISTRIBUTION THROUGH MOBILIE CLINIC

DEWORMING WITH MEBENDAZOLE

b. IFA Distribution through clinics. The study area K.V.Kuppam block is catered through 18 Peripheral Service Units (PSU). Each PSU has an average of 5000 population. A Family Care Volunteer (FCV) is taking care of an average of 200 household. There is one Health Aide (HA) who maintains the registers, records for every PSU. One Rural Community Officer (RCO) is incharge of 2 PSUs. All the pregnant women were identified by the FCVs and reported to the respective HAs every week. There is a mobile clinic conducted every week in each PSU. The iron tablets are made available free of cost in all the mobile clinics and distributed from the 4th month of pregnancy. Due care was taken for the surplus availability of iron tablets in neatly packed sachets, with each packet consisting of 30 tablets. While distribution communication was made to each pregnant women that, consumption of these iron tablets per day after the meal will increase their iron status in the body. Pregnant women were encouraged to obtain IFA tablets distributed by Government Village Health Nurse (VHN) at home and also from the sub centres and Primary Health Centre (PHC).

2. IEC - COMMUNITY BASED EDUCATION INTERVENTION FOR BEHAVIOUR CHANGE.

a. IEC Materials Prepared

i. Messages on anemia

Messages on anemia were developed through a participatory process involving all levels of workers and volunteers. Initially there were 12 messages on anemia which were printed as hand bills and distributed to each home in K V Kuppam Block through FCVs. Subsequently they were modified to 7 simple messages that were appropriate for the community and easy for the health workers to remember and disseminate. Information on anemia was printed as handbills to be distributed along with the mass campaign. While these were important this was only a support to the overall education program.

ii. Flash Cards

A set of flash cards containing 12 pictures were developed on the basis of the same messages. These flash cards were used by the FCVs during one to one education to the pregnant women at home, by the RCOs and Health Aides during the group education in their mobile clinics and by FCVs in the community. They found the pictures easy to explain. The FCVs considered this the most effective tool as it was always available in their hand and one which they could use confidently.

iii. Booklet

A booklet was prepared expanding on the messages to be used as a guide by the HA, RCOs and other staff of RUHSA and Government staff and teachers in the schools of K.V. Kuppam Block. This was also considered very effective as it was in their own hands. This was very helpful for young educated women. Some left them in educated individual's homes overnight for people to read.

IEC MATERIALS PREPARED AND USED

RCO EDUCATING FCVS ON THE USE OF BOOKLET

RCO DISTRIBUTING AUDIO CASSETTE TO FCV

iv. Video

A video was prepared to convey the messages on anemia. This was used in the community by screening in an average of 5 houses in each PSU for at least one group organised by each FCV. An autorickshaw was hired to screen this in all the 18 PSUs of K.V. Kuppam Block. Since time was short and its access was limited, the FCVs did not value this much. However, for the adolescent girls both in the community and in the schools it was considered effective. Using rural people involved in the routine work in the area made it easy for them to identify with the video.

v. Audio Cassettes

An audio cassette consisting of 8 songs on anemia along with a commentary was released. These were provided to the FCVs to rotate through different homes where a tape recorder was available. Each FCV made this available to about 4-6 houses. Some used this in tea shops and also broadcast the songs through public address system during special functions.

b. Various Approaches Followed in IEC

Pregnant women

i. One to one Education:

FCV visited each one of the pregnant women in her area through out the project period and educated her on the messages of anemia using the flash cards. This visit was made frequently during the pregnancy period. Thus the entire study block was covered by 117 FCVs each serving an average of 1000 population.

ii. Group teaching in the community

FCVs and the respective RCOs gathered groups of pregnant women in her area.(Supervisor and the field staff made an assessment of the knowledge of pregnant women by asking questions to verify the impact of one to one teaching by FCVs). FCV taught the groups about the facts of anemia using flash cards. Field staff asked questions to the group to make sure that each pregnant women was knowledgeable about anemia. All the doubts raised by pregnant women were clarified by the field staff. The discussions held were lively. The group teaching came to an end when all doubts were clarified. This group teaching was carried out in all 117 FCV areas gathering them in one or two villages of each FCV.

iii. Group teaching in the clinic

Mobile clinics are conducted each week in each PSU in the study block routinely. This is manned by a doctor, a nurse along with RCO, HA and FCVs of that respective PSU. During this clinic RCO, FCV and HA together gathered the pregnant women and taught them on the messages of anemia using flash cards and discussion.

ONE TO ONE EDUCATION: FCV TO PREGNANT WOMAN

ONE TO ONE EDUCATION: RCO TO PREGNANT WOMAN

GROUP TEACHING: NURSE IN THE MOBILE CLINIC

Adolescent Girls

i. Workshop in the community

A need based curriculum was planned to conduct the workshop for adolescents. This was carried out in the month of May 1998 in 36 villages with 2 centres in each making sure to cover 18 PSUs. The vacation month was ideal This enabled the girls to attend as the centres were easily accessible. A total of 10 staff members were trained to carry out this program (including nurses, RCOs, Health Educator). The program consisted of 2 short lectures on anemia in pregnancy and adolescence, separately backed by flash cards and video. Lively discussion followed each program lasting about 3 hours. Lunch was provided to all the participants. Some parents refused to send their adolescent daughters for education on a topic involving pregnancy. This was considered the most effective program and if we had given prizes to the best students the enthusiasm would have probably been even more. The system approach and curriculum followed are given in Appendix-G and Appendix-H respectively.

ii. Workshop in the school

A half day program on anemia was arranged in all the 12 high schools (except one) in K.V.Kuppam Block with the permission of the Head Master of the school. A structured curriculum was followed uniformly in all the schools. Facts on anemia were taught using flash cards and by distributing pamphlets. The video on anemia was screened. After this a review was done by asking questions. Pre evaluation was carried out to assess the knowledge of girls before the education. Then post evaluation was carried on to assess the increase in knowledge after education. The questions were written on the board separately. As it was the beginning of school, it did not affect classes and was welcomed.

General Population

i. The general population was covered in most group education processes when videos were displayed by the FCVs in homes and in the community.

ii. Campaign approach

Mass Campaigns have been one of RUHSA's main strategies for behavior modification on any area. We did not want to miss this for anemia control. In this campaign a loud speaker was fitted onto a RUHSA vehicle with an amplifier, tape recorder and a mike. Songs on anemia were played. The health educator,nurses and other students were used in broadcasting messages in the villages. Normally we would cover each peripheral service unit in one full day. Due to shortage of time we could carry this out totally only for five days. Following the broadcast of messages, printed hand bills were distributed to those people requesting and those in the vicinity. In this way messages on anemia were disseminated among the general community as well.

3. Deworming

Pregnant women were issued mebandazole tablets in the mobile clinics routinely either in the second or third trimester. Each woman received six tablets of 100 mg each with instructions to take one tab twice daily for three days. There were certain ethical questions raised by young medical graduates who were involved in the program. To satisfy their needs, attempts were made to get additional information on this aspect from Mother Care.

4. Monitoring Method

a. Pregnant women identification and recording

FCV identified all the pregnant women in her area and wrote it in her note book. All FCVs of one PSU reported this to the respective Health Aide once a week either on the clinic day or at the review meeting time. The HA ***recorded*** it in her PSU antenatal register. This FCV identification of the pregnant mother early was monitored by RCO and the field staff when they went for supervisory visits.

b. Pregnant women registration

FCV motivated each pregnant woman to come for early registration. A HA ***registered*** the pregnant woman when she came for an antenatal check up either to the mobile clinic or to RUHSA Hospital. If she was registered in the Government or outside, the information was obtained by FCV or HA or RCO of that respective PSU. There is a weekly review meeting held at each PSU amongst RCO, HA and FCV. This helped in discussing the problems of identification and registering of pregnant women and sorting out problems.

c. Procurement of IFA and Mebendazole

When pregnant women came for antenatal check ups, they were issued 30 IFA tablets by the mobile doctors, nurse, RCO or HA. If her first visit was in the 1st trimester she was issued IFA in her subsequent visits at the 4th month. These were registered on the ANC register on the day of the clinic or the following day transferring it from the AN card of each pregnant women. This recorded information on the register maintained by the HA was computerised every month by the statistical assistant in the centre. This was consolidated and made available for discussion in the review meetings at CSU. Once in a month or two, a review meeting was held in CSU for all FCV & HA, on the early identification, early registration procurement of IFA and Mebex etc. There was a discussion and comparison made among FCVs and between PSUs on their performance.

d. Consumption of IFA by pregnant women

FCV during her field visit to each pregnant woman confirmed the consumption of IFA by counting the left over tablets. Field visit was made by the field staff for supervising the education given to pregnant women by FCV and consumption of IFA by

counting the left over tablets. At later stages of the project a monitoring card was issued to each pregnant women in the clinic and they maintained the card for a month and made ticks and returned it to the nurses in the clinics. This served the purpose of knowing the consumption status of pregnant women.

e. IEC Component

The one to one education to pregnant women was monitored during the field visits of the supervisory staff by enquiring the pregnant women and confirming the knowledge obtained by each. The same was verified during the group teaching conducted by the field staff in each FCV area organised collectively by RCO and FCV. The field staff maintained a note book to record their visits and submitted a report.

The group teaching was scheduled with a structured program. According to the program plan, this was supervised by the Assistant Project Officer through spot checks.

The clinic based group teaching was scheduled every week in all the mobile clinics either by clinic or by the RCO or by HA or collectively. These were monitored by the field staff, program assistant and Co-investigator regularly. The effectiveness of these programs were discussed during the regular monthly review meetings.

Review meetings were held at RUHSA once in a month or once in two months. During this meeting a quiz and individual assessment were conducted to verify knowledge of all the health care providers by reciting the messages on anemia correctly.

Adolescents

f. Workshop in Schools

This again was a structured program conducted in each school for the girls. This program was monitored through a Pre-Post test carried out to measure the knowledge change among the adolescent girls. The consolidated increase in marks are attached in appendix J.

g. Workshop in the Community

It was a structured program conducted through out the Block with scheduled dates. In each workshop, a quiz was conducted to make sure the knowledge on anemia was transferred effectively. The groups were divided into 3 or more according to the strength in each place and marks were given to each group. The marks obtained by each group gave the monitoring data on the performance of this workshop. This is attached in the appendix K.

WEEKLY REVIEW MEETING AT PSU BY RCO

MONITORING IFA CONSUMPTION BY PROGRAM STAFF

PROGRAM STAFF CONFIRMING FCV KNOWLEDGE ON ANEMIA

VII. RESULTS

A. PREGNANT WOMEN

1. PROFILE OF THE SUBJECTS AND COMPARABILITY

A detailed profile of the subjects interviewed before and after intervention in both areas is presented according to their socio economic status, demographic and obstetric characteristics and nutritional status in Table 1.1, Table 1.2, Table 1.3 and Table 1.4 respectively. These tables indicate that both the groups selected are similar and comparable with respect to many of the socio, economic and demographic variables having no significant difference. (This component is dealt in detail in the base line report) indicating equal socio economic status, during the pre intervention assessment.

Little more than 30% of the subjects are from the scheduled caste, around 60% of them backward caste and less than 10% are from the forward caste among the sample subjects in the study and control area during pre and post intervention assessment, except a higher percentage of schedule caste in the control area during post assessment.

Around 50% lived in houses with thatched roof, little less than 30% in houses with tiled roof and almost one fourth of them live in houses with terraced roof in each group, during pre and post intervention assessment. Nearly 40%-50% lived in one room house, around 30% in two room houses and 15% to 25% had more than three rooms.

The majority of those surveyed did not have latrines in their houses. Little more than 40% belongs to nuclear family, little less than 40% joint family and the rest were extended family. Around 70% had less than 5 persons in their family, almost one fourth of them had 6 to 10 persons and few had more than 10 persons in their families.

The subjects were in the age group of 14 to 42 years however more than 90% of them were within 14 - 30 years. The mean and the SD of their age were 22 (SD 3.7-4), in both the assessments. Over 80% of them had attained their puberty at 14 years or more. The mean age at menarche was 14 years in the study and control areas. Almost three fourths of them in both the areas had their age at marriage in their adolescent period of 10 - 19 years. The mean age at marriage was 18 years for all the groups. Almost 95% of them had their first pregnancy before their 24th year, with more than 50% during their adolescent period itself. The mean age at first pregnancy was observed to be 19 years (SD 2.4-2.7).

About 35% of the women were in the Primigravida and another segment of the same percentage in the second gravida and the rest above second. Little less than 40% of the women in each group were in the primi para and 30 - 35% in the second para and the rest above two. Very few of the mothers had experienced, abortions, still births and deaths during their previous conceptions. Around 10% of the mothers had less than or equal to 12 weeks gestation, 40%-50% in the 13 - 27 weeks and 40% were more than 28 weeks of gestation in all the groups approximately.

TABLE 1.1: PREGNANT WOMEN BY SOCIO ECONOMIC STATUS IN STUDY AND CONTROL AREA BEFORE AND AFTER INTERVENTION

SOCIO ECONOMIC VARIABLES	K.V. KUPPAM				GUDIYATHAM			
	PRE		POST		PRE		POST	
	No.	% N=522	No.	% N=409	No.	% N=510	No.	% N=464
1. CASTE								
S C	161	30.8	128	31.3	174	34.1	219	47.2
B C	324	62.1	251	61.4	312	61.2	228	49.1
F C	37	7.1	30	7.3	24	4.7	17	3.7
2. ROOF								
Thatched	250	47.9	159	38.9	272	53.3	227	48.9
Tiled	144	27.6	136	33.2	138	27.1	136	29.3
Terraced	128	24.5	114	27.9	100	19.6	101	21.8
3. NO. OF ROOMS								
One Room	226	43.3	188	46.0	204	40.0	263	56.7
Two Rooms	168	32.2	142	34.7	220	43.1	136	29.3
Above Three Rooms	128	24.5	79	19.3	86	16.9	65	14.0
4. LATRINE								
No	466	89.3	356	87.0	489	95.9	394	84.9
Yes	56	10.7	53	13.0	21	4.1	70	15.1
5. FAMILY TYPE								
Nuclear	243	46.6	166	40.6	208	40.8	218	47.0
Extended	75	14.4	113	27.6	110	21.6	122	26.3
Joint	204	39.0	130	31.8	192	37.6	124	26.7
6. FAMILY SIZE								
1 - 5	361	69.2	288	70.4	334	65.5	319	68.8
6 - 10	144	27.6	113	27.6	157	30.8	127	27.3
Above 11	17	3.2	8	2.0	19	3.7	18	3.9

7. RESPONDENT'S EDUCATION

No Education	132	25.3	86	21.0	192	37.7	136	29.3
1 - 5	148	28.4	72	17.6	105	20.6	128	27.6
6 - 8	139	26.6	121	29.6	126	24.7	107	23.1
9 - 10	75	14.4	97	23.7	65	12.7	71	15.3
11 - 12	21	4.0	24	5.9	17	3.3	19	4.1
Dip/BSc/MSc	7	1.3	9	2.2	5	1.0	3	0.6

8. HUSBAND'S EDUCATION

No Education	97	18.6	89	21.8	158	31.0	123	26.5
1 - 5	101	19.3	58	14.2	100	19.6	83	17.9
6 - 8	131	25.1	90	22.0	118	23.1	114	24.6
9 - 10	133	25.5	127	31.1	90	17.6	99	21.3
11 - 12	34	6.5	26	6.3	34	6.7	29	6.3
Dip/BSc/MSc	26	5.0	19	4.6	10	2.0	16	3.4

9. WOMAN'S OCCUPATION

House Wife	320	61.3	302	73.8	312	61.2	359	77.4
Cooly	88	16.9	82	20.1	143	28.0	71	15.3
Fam.Occupation	43	8.2			17	3.3		
		}	22	5.4		}	26	5.6
HW & Farm.Occ	61	11.7			26	5.1		
Others	10	1.9	3	0.7	12	2.4	8	1.7

10. HUSBAND'S OCCUPATION

Agri Cooly	184	35.3	275	67.2	215	42.1	295	63.6
P. Business	18	3.5	23	5.6	10	2.0	10	2.2
F.Occ & Mason	42	8.0	30	7.3	52	10.2	61	13.1
Beedi Making	79	15.1	37	9.0	35	6.9	41	8.8
Class - IV	55	10.5	11	2.8	70	13.7	44	9.5
Farmer	88	16.9	-	-	98	19.2	-	-
W.Col / Big Business	56	10.7	33	8.1	30	5.9	13	2.8

Nutritional status indicated by height(<150 cm) and weight (<45 kg) was significantly (P<0.001) better among study area pregnant women than control (Table 1.4). The mean height and mean weight also were significantly (P<0.001) higher in the study area than in the control area (Table 1.5). More than 55% of them had low BMI in both the areas, however the proportion of women with normal BMI was significantly (P<0.05) higher in the study area. This could be because of the intervention that went in to the study area over the years.

TABLE 1.2 : PREGNANT WOMEN BY OBSTETRIC FACTORS IN STUDY AND CONTROL AREAS BEFORE AND AFTER INTERVENTION

OBSTETRIC VARIABLES	K.V. KUPPAM				GUDIYATHAM			
	PRE		POST		PRE		POST	
	No.	% n=522	No.	% n=409	No.	% n=510	No.	% n=464
1. AGE								
14 - 19	154	29.5	71	17.4	128	25.1	73	15.7
20 - 24	238	45.6	209	51.1	242	47.4	250	53.9
25 - 29	111	21.3	107	26.1	105	20.6	100	21.6
30 - 42	19	3.6	22	5.4	35	6.9	41	8.8
2. AGE AT MENARCHE								
≥ 15	221	42.3	206	50.4	178	34.9	140	30.2
14	215	41.2	134	32.8	240	47.1	130	28.0
13	70	13.4	52	12.7	76	14.9	124	26.7
≤ 12	16	3.1	17	4.1	16	3.1	70	15.1
3. AGE AT MARRIAGE								
10 - 15	62	11.9	20	4.9	55	10.8	39	8.4
16 - 19	345	66.1	238	58.2	356	69.8	298	64.2
20 - 24	108	20.7	141	34.5	89	17.4	117	25.2
25 - 31	7	1.3	10	2.4	10	2.0	10	2.2
4. AGE AT FIRST PREGNANCY								
16 - 19	341	65.3	201	49.1	320	62.8	243	52.3
20 - 24	158	30.3	188	46.0	171	33.5	192	41.4
25 - 35	23	4.4	20	4.9	19	3.7	29	6.3
5. GRAVIDA								
1	182	34.8	134	32.8	179	35.1	166	35.8
2	183	35.1	152	37.2	147	28.8	138	29.7
3	86	16.5	73	17.8	89	17.5	96	20.7
≥ 4	71	13.6	50	12.2	95	18.6	64	13.8

OBSTETRIC VARIABLES	K.V. KUPPAM				GUDIYATHAM			
	PRE		POST		PRE		POST	
	No.	% n=522	No.	% n=409	No.	% n=510	No.	% n=464
6. PARITY								
0	201	38.5	161	39.3	195	38.2	182	39.2
1	182	34.9	143	35.0	152	29.8	147	31.7
2	81	15.5	71	17.4	84	16.5	80	17.2
3	37	7.1	25	6.1	49	9.6	29	6.3
≥ 4	21	4.0	9	2.2	30	5.9	26	5.6
7. ABORTIONS								
≥ 2	8	1.6	10	2.5	17	3.3	8	1.7
1	43	8.2	48	11.7	36	7.1	27	5.8
0	471	90.2	351	85.8	457	89.6	429	92.5
8. STILL BIRTH								
≥ 2	1	0.2	1	0.3	1	0.2	3	0.6
1	13	2.5	3	0.7	18	3.5	19	4.1
0	508	97.3	405	99.0	491	96.3	442	95.3
9. DEATHS								
≥ 2	10	1.9	4	1.0	11	2.2	8	1.7
1	38	7.3	34	8.3	36	7.0	29	6.3
0	474	90.8	371	90.7	463	90.8	427	92.0
10. LIVING CHILDREN								
0	216	41.4	188	46.0	207	40.6	202	43.5
1	186	35.6	137	33.5	159	31.2	143	30.8
2	83	15.9	58	14.2	82	16.0	74	16.0
≥ 3	37	7.1	26	6.3	62	12.2	45	9.7
11. GESTATIONAL AGE								
No information	6	1.2	-	-	57	11.2	-	-
1st Trimester	46	8.8	36	8.8	42	8.2	33	7.1
2nd Trimester	246	47.1	193	47.2	181	35.5	249	53.7
3rd Trimester	224	42.9	180	44.0	230	45.1	182	39.2

12. SPACING
(Months)

≤ 12	103	30.3	91	33.1	79	23.9	80	26.9
13 - 24	123	36.2	111	40.4	146	44.1	102	34.2
Above 25	114	33.5	73	26.5	106	32.0	116	38.9
	*		$		*		$	
Total	340	100.0	275	100.0	331	100.0	298	100.0

* 182 pregnant women from K.V. Kuppam block and 179 pregnant women from Gudiyatham block were primi gravida mothers, before intervention.

$ 134 pregnant women from K.V. Kuppam block and 166 pregnant women from Gudiyatham block were primi para mothers, after intervention.

TABLE 1.3 : MEANS, SD AND RANGES OF AGE'S AT DIFFERENT VITAL EVENTS BEFORE AND AFTER INTERVENTION

PARAMETERS	K.V.KUPPAM		GUIDYATHAM	
	PRE n=522	POST n=409	PRE n=510	POST n=464
AGE				
Mean	22.03	22.88	22.42	22.91
SD	3.71	3.75	4.18	4.05
Range	14 - 40	16 - 37	14 - 40	14 - 42
AGE AT MENARCHE				
Mean	14.48	14.48	14.27	13.85
SD	1.26	1.16	1.02	1.38
Range	11 - 26	11 - 19	11 - 18	10 - 23
AGE AT MARRIAGE				
Mean	18.00	19.05	17.91	18.48
SD	2.41	2.34	2.33	2.34
Range	10 - 31	14 - 29	10 - 28	12 - 30
AGE AT 1ST PREGNANCY				
Mean	19.12	19.93	19.04	19.62
SD	2.62	2.46	2.39	2.70
Range	14 - 34	14 - 29	13 - 29	13 - 35

TABLE 1.4: PREGNANT WOMEN BY THEIR NUTRITIONAL STATUS IN STUDY AND CONTROL AREAS BEFORE INTERVENTION

NUTRITION VARIABLES	K.V.KUPPAM		GUDIYATHAM		
	NO	PERCENTAGE N=522	NO	PERCENTAGE N=510	SIG LEVEL
HEIGHT					
≤ 144.9	33	6.3	57	11.2	P<0.01
145.0 - 149.9	106	20.3	148	29.0	P<0.01
≥ 150.0	383	73.4	305	59.8	P<0.001
WEIGHT					
≤ 37.9	31	5.9	63	12.3	P<0.001
38.0 - 39.9	34	6.5	35	6.9	
40.0 - 44.9	140	26.8	170	33.3	P<0.05
≥ 45.0	317	60.8	242	47.5	P<0.001
ARM CIRCUMFERENCE					
≤ 22.9	136 *	26.1	147	28.8	NS
≥ 23.0	385	73.9	363	71.2	NS
BMI					
< 16.00	14	2.7	31	6.1	
16.01 - 17.00	43	8.2	45	8.8	
17.01 - 18.50	102	19.5	119	23.3	
18.51 - 20.00	136	26.1	132	25.9	
20.01 - 25.00	204	39.1	170	33.3 }	
				}	P<0.05
25.01 - 30.00	23	4.4	13	2.6 }	

Note: * One case - No information on Arm circumference.

TABLE 1.5: MEAN, SD AND RANGE OF Ht, Wt & AC IN STUDY AND CONTROL AREA BEFORE INTERVENTION

BLOCK	VARIABLES	MEAN	95% CI	SD	RANGE
K V KUPPAM	Ht	153.29 *	152.9-153.8	5.44	137.9 - 168.7
N = 522	Wt	46.93 $	46.3- 47.5	6.76	30.0 - 72.0
	AC	24.18 #	24.0- 24.4	2.32	19.7 - 33.1
GUDIYATHAM	Ht	151.72 *	151.2-152.3	5.82	123.5 - 166.1
N = 510	Wt	44.65 $	44.1- 45.2	6.39	29.0 - 73.0
	AC	23.93 #	23.7- 24.1	1.98	18.8 - 32.0

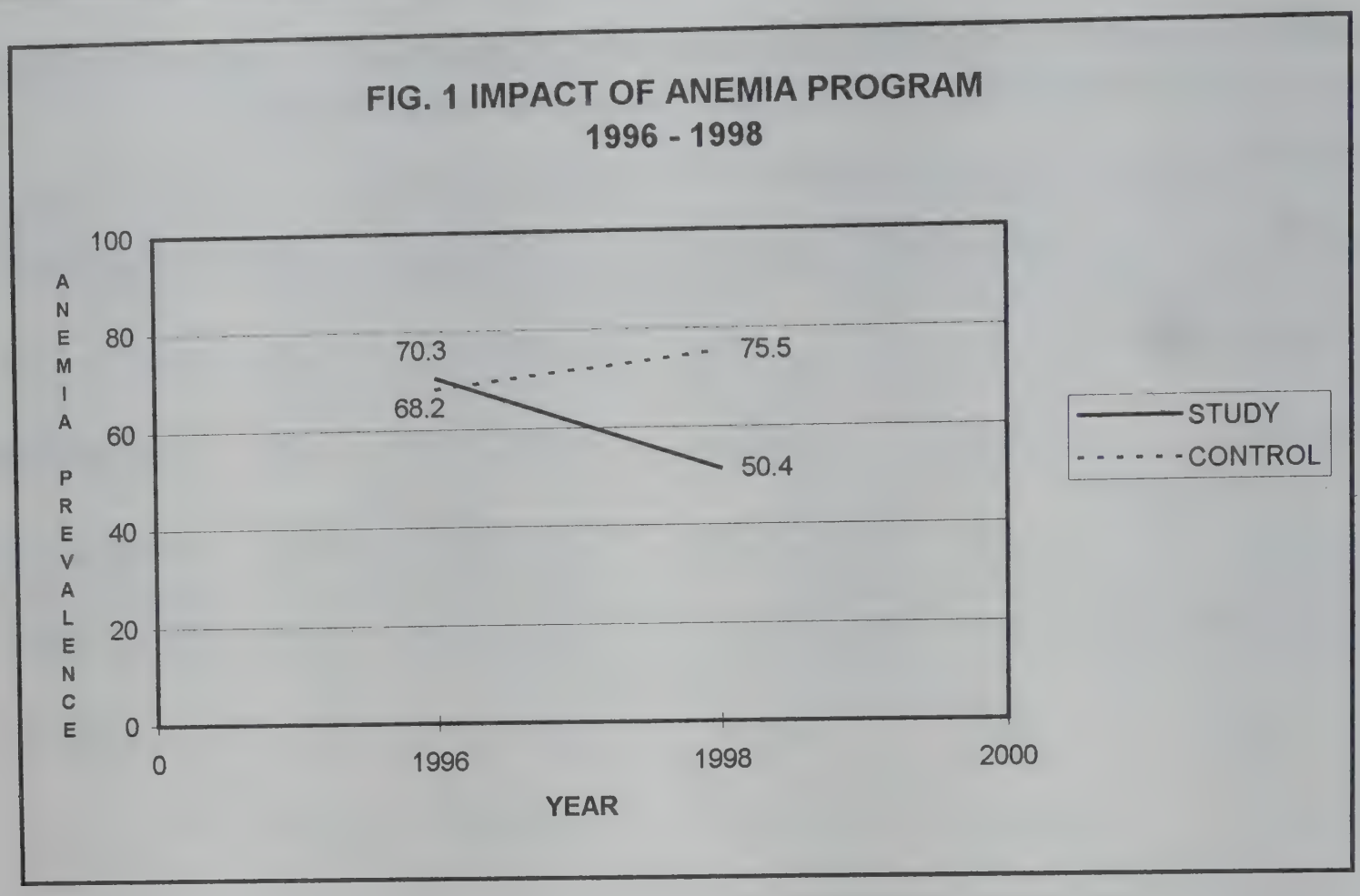
*, $ - P<0.001 # - NOT SIGNIFICANT

2. ANEMIA AND IRON DEFICIENCY PREVALENCES AND STATISTICS

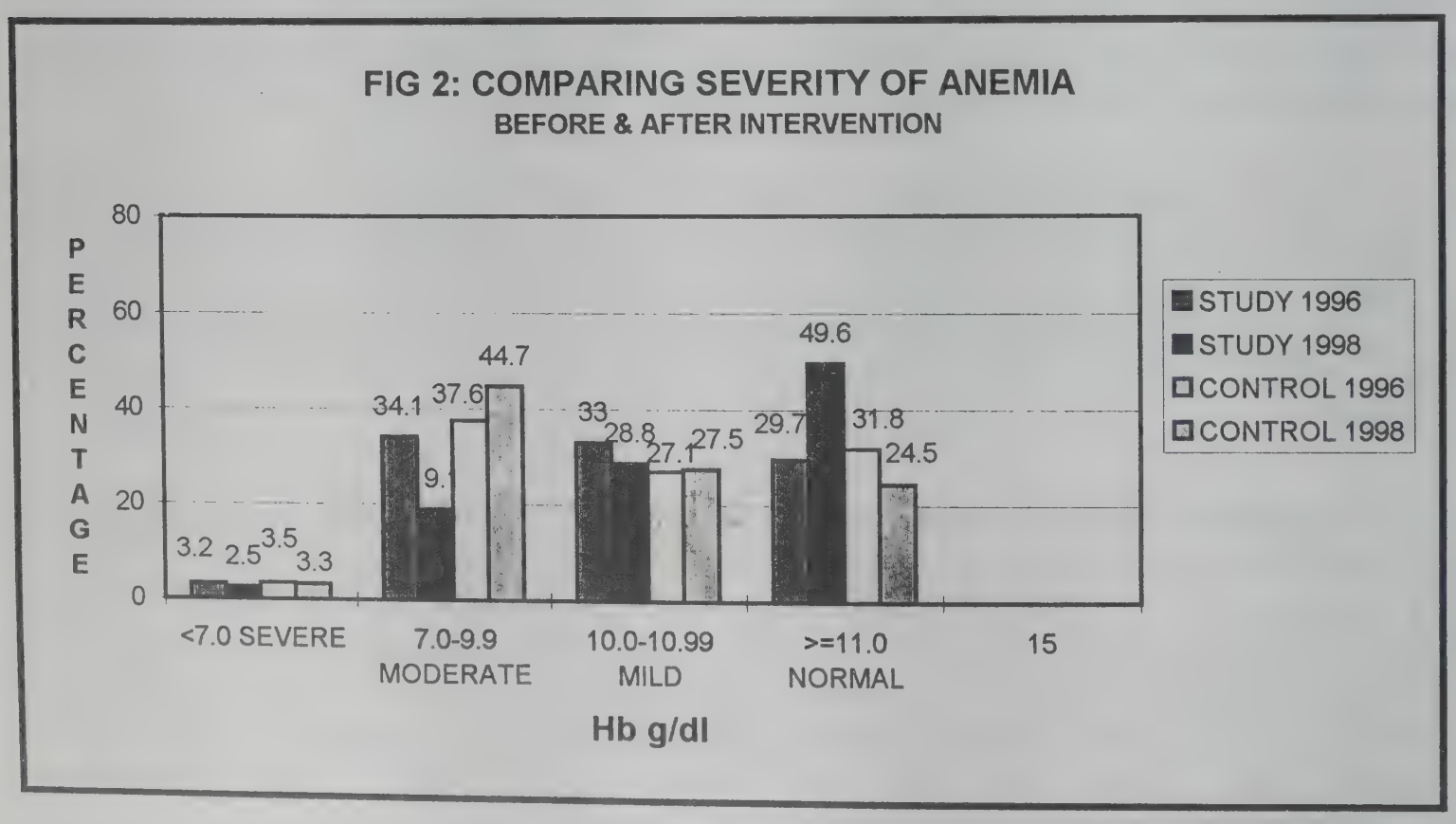
A total of 522 and 510 (Pre), 409 and 464 (Post) pregnant women were interviewed during pre and post intervention in the study and control groups. The knowledge, attitude and practice related to maternal anemia were elicited from each one of them. However, maternal hematological status was measured only from 464 and 431 during pre intervention and 403 and 425 after intervention from the study and control area respectively. Maternal serum ferritin level was obtained from 260 and 211 before intervention, 216 and 223 after intervention in the study and control area.

In the pre intervention survey, 7 pregnant women in the study area iron storage was nil indicating a serum ferritin value of 0.01 μg/L. In the post intervention survey one women had extreme high SF value of 573 μg/L in the study area and the latter was excluded only for SF analysis. The gestational ages were not obtained from 6 and 44 pregnant women during pre intervention survey in the study and control area respectively.

The program objective intended a reduction of 15% over 2 years. The prevalence of iron deficiency anemia among pregnant women (Hb <11g/dl) had a significant (P < 0.001) decrease of 19.9% in the study area from 70.3% to 50.4% and surprisingly a significant (P<0.05) increase of 7.3% was observed in the control area from 68.2% to 75.2% (Fig 1) which accounts for a 27.2% difference in the study area. The difference in the anemia prevalence between the study and control areas during post intervention assessment was 25.1% with 95% CI 17.6% - 30.6% and the difference is significant(P<0.001) Table 2.1.



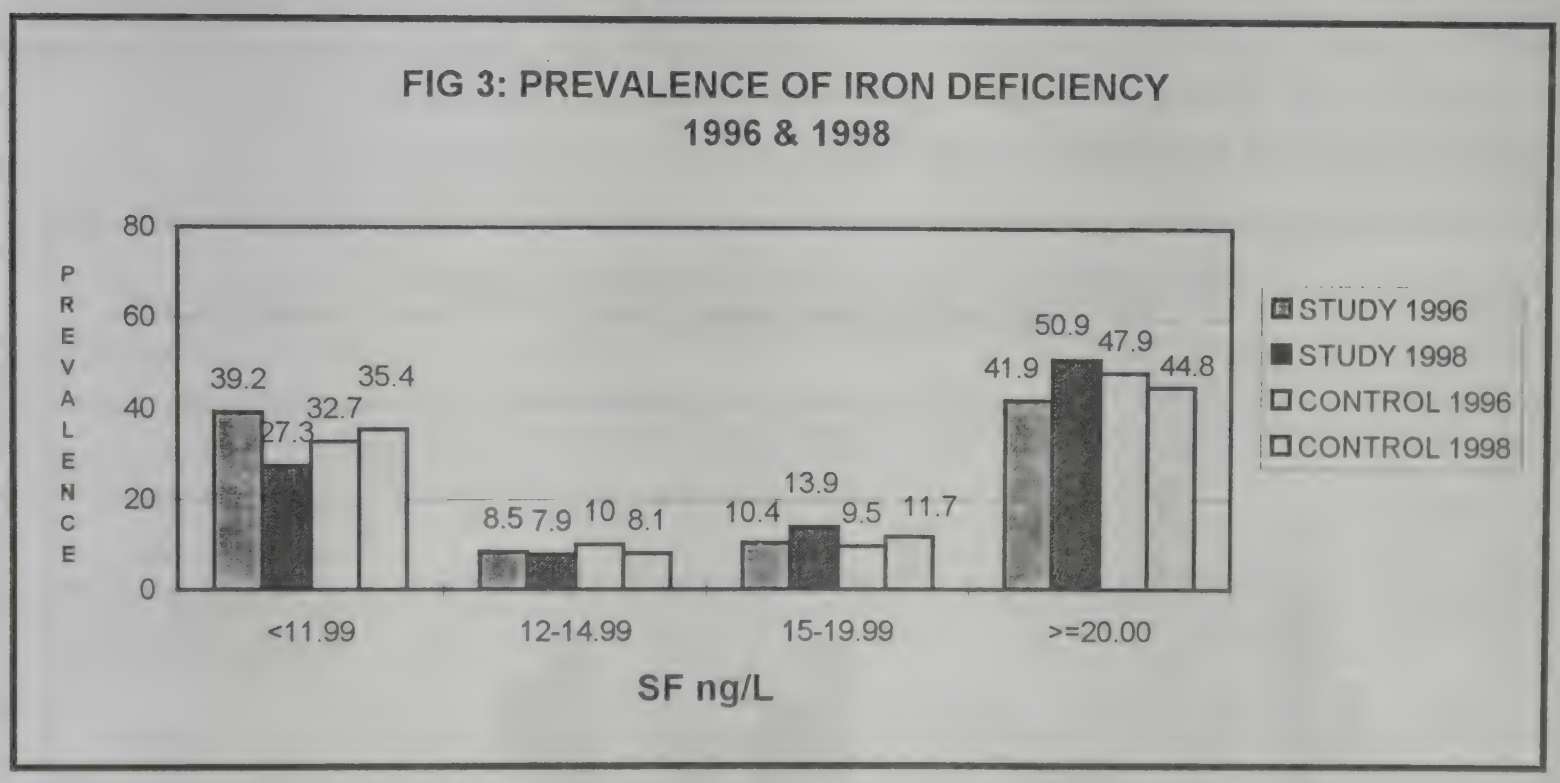
The mean and SD of maternal hemoglobin concentration before intervention, in the study and control area was observed as 10.16 g/dl (1.4 SD) and 10.12 g/dl (1.52 SD) and after intervention was 10.69 g/dl (1.49 SD) and 9.90 g/dl (1.43 SD). The difference in the mean HB level between pre and post was found to be significant ($P<0.001$) in the study area. The maternal hemoglobin concentration ranged from 4.60 g/dl to 14.10 g/dl and 3.0 g/dl to 13.9 g/dl before intervention in the study and control area respectively and from 4.7 g/dl to 13.9 g/dl and 4.4 g/dl to 13.2 g/dl after intervention in the study and control area respectively. (Table 2.2)



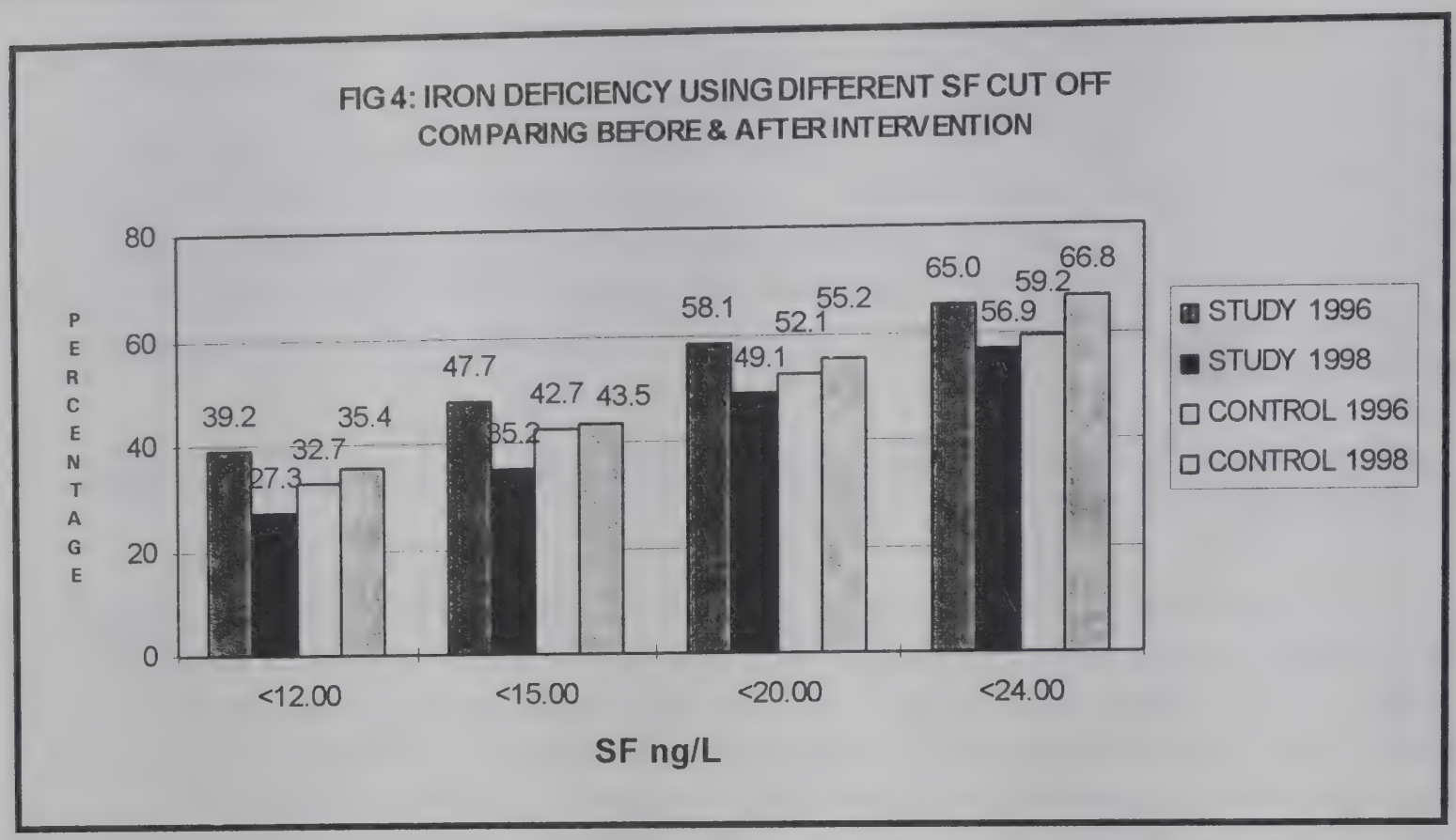
In the intervention area the reduction in the prevalence of severe anemia (Hb < 7.0) was from 3.2% to 2.5% (0.7%), in moderate anemia (Hb 7 g/dl - 9.99 g/dl) it was from 34.1% to 19.1% (15.0%) and in mild anemia (Hb 10.0 g/dl - 10.99 g/dl) it was from 33% to 28.8% (4.2%) (Fig 2). A greater significant (P<0.001) reduction was observed in moderate anemia. In the control area a non significant increase in the prevalence was observed in the same moderate anemia where as severe and mild remained the same in the 2 years time which resulted in the increase in the overall prevalence of anemia. (Table 2.3)

3. PREVALENCE OF IRON DEFICIENCY (SF <12 µg/L) AMONG PREGNANT WOMEN

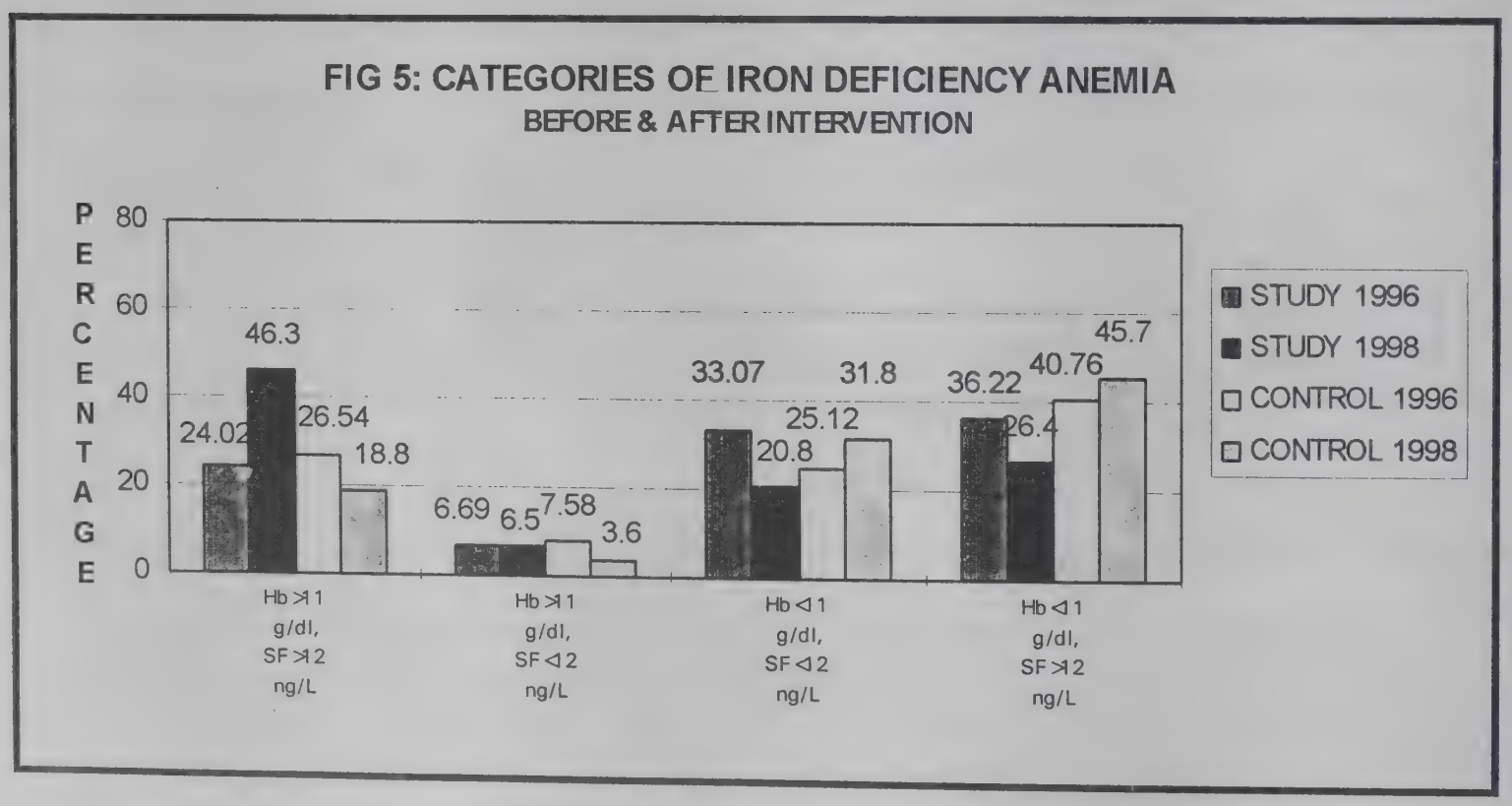
The maternal iron status was measured by serum ferritin estimation,indicating for iron depletion which is a decrease in iron stores. The serum ferritin level ranged from 0.1µg/L to 153.0µg/L and 1.5µg/L to 91.3µg/L before intervention in the study and control areas respectively and it ranged from 2.5µg/L to 138.4µg/L and 1.4µg/L to 115.9µg/L after the intervention in the study and control areas respectively. Seven women in the study area before intervention had SF 0.1µg/L indicating absence of iron stores. The mean and standard deviation of Serum Ferritin concentration was 23.31µg/L (SD 21.61) and 25.69µg/L (SD 19.49) before and after intervention in the study area and it was 24.45µg/L (SD 18.78) and 22.09µg/L (SD 17.8) respectively in the control area. The increase in the mean SF level in the study area was not found to be significant. (Table 2.2)



A significant (P<0.01) decrease of 11.9% in the prevalence of iron deficiency with SF < 12µg/L from 39.2% to 27.3% was observed in the study area and surprisingly an increase of 2.7% in the control area in the same period which accounts for a total difference of 14.6% (Fig 3). There is a non significant reduction in the prevalence of iron deficiency (SF < 24 µg/L) in the study area from 65.0% to 56.9% (8.1%) and a non significant increase of 7.6% from 59.2% to 66.8% was observed in the control area during the same period.



The SF cut offs are not decided specifically as it was done for Hb. Different researchers had used different cut offs. The table 2.4 presents the prevalence of iron deficiency according to different cut offs of SF value. Which ever cut off, is used, it is obvious that there is a reduction in the prevalence between pre and post intervention in the study area.(Fig. 4) This decrease was significant ($P<0.01$) with SF <12µg/L and SF <15µg/L and significant ($P<0.05$) with SF <20µg/L and the decrease was not significant with cut off of SF <24µg/L. A non significant increase in the control area was observed with each SF cut off between the same time.



Categorising the iron deficiency and anemia according to Cook and Skikne, a significant ($P<0.001$) increase from 24.02% to 46.3% was observed in the study area

after intervention in the no iron deficiency category (Hb >11 g/dl and SF >12 µg/L). However there was a decrease from 26.54% to 18.8% in the control area which was not significant. There was no change found in the storage depletion category (Hb >11 g/dl and SF <12 µg/L) in the study area before and after intervention.(Fig.5).

Iron deficiency anemia as it is categorised by Hb <11 g/dl and SF <12 µg/L, shows a significant (P <0.01) decline from 33.07% to 20.8% in the study area where as in the control area, a nonsignificant increase is observed. Even among other causes of anemia (Hb <11 g/dl and SF >12 µg/L), a significant (P<0.05) reduction is observed. This is shown in Table 2.6 and 2.7.

4. PREVALENCE OF ANEMIA AMONG PREGNANT WOMEN OF DIFFERENT SOCIO ECONOMIC GROUPS

The prevalence of hemoglobin concentration < 11g/dl with different socio economic status according to selected variables is presented in Table 2.8. The prevalence of anemia showed a significant decrease in the study area between Pre and Post intervention with respect to each socio economic variable. This decrease in the prevalence is distributed evenly within each group of the variable irrespective of low, middle and high status. However in the control area there is a slight increase in the prevalence among all the variables and it is observed in all groups of women with respect to each variable between pre and post intervention time. (Table 2.8)

The same above observation holds good with all the demographic and obstetric variables considered in this study. This is shown in Table 2.9.

5. PREVALENCE OF ANEMIA AMONG PREGNANT WOMEN OF DIFFERENT NUTRITIONAL GROUPS

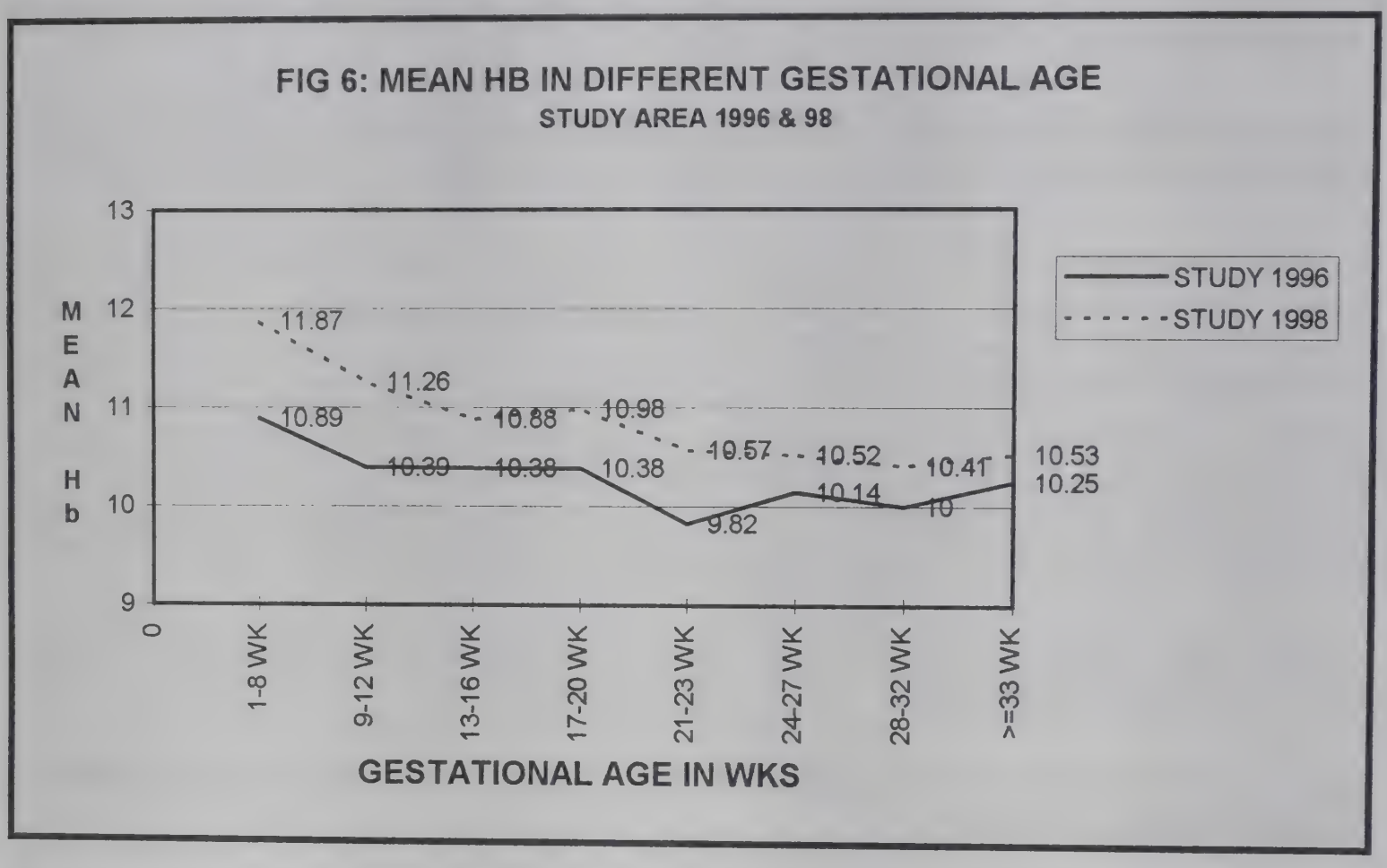
The prevalence of anemia was comparatively less among those whose height is equal to or above 150 cm in the study area. There is no difference observed among the different height group of women in the control area. The same was observed with weight and Body Mass Index (BMI). Nutritional status was measured only during the pre intervention time in both the areas. (Table 2.10)

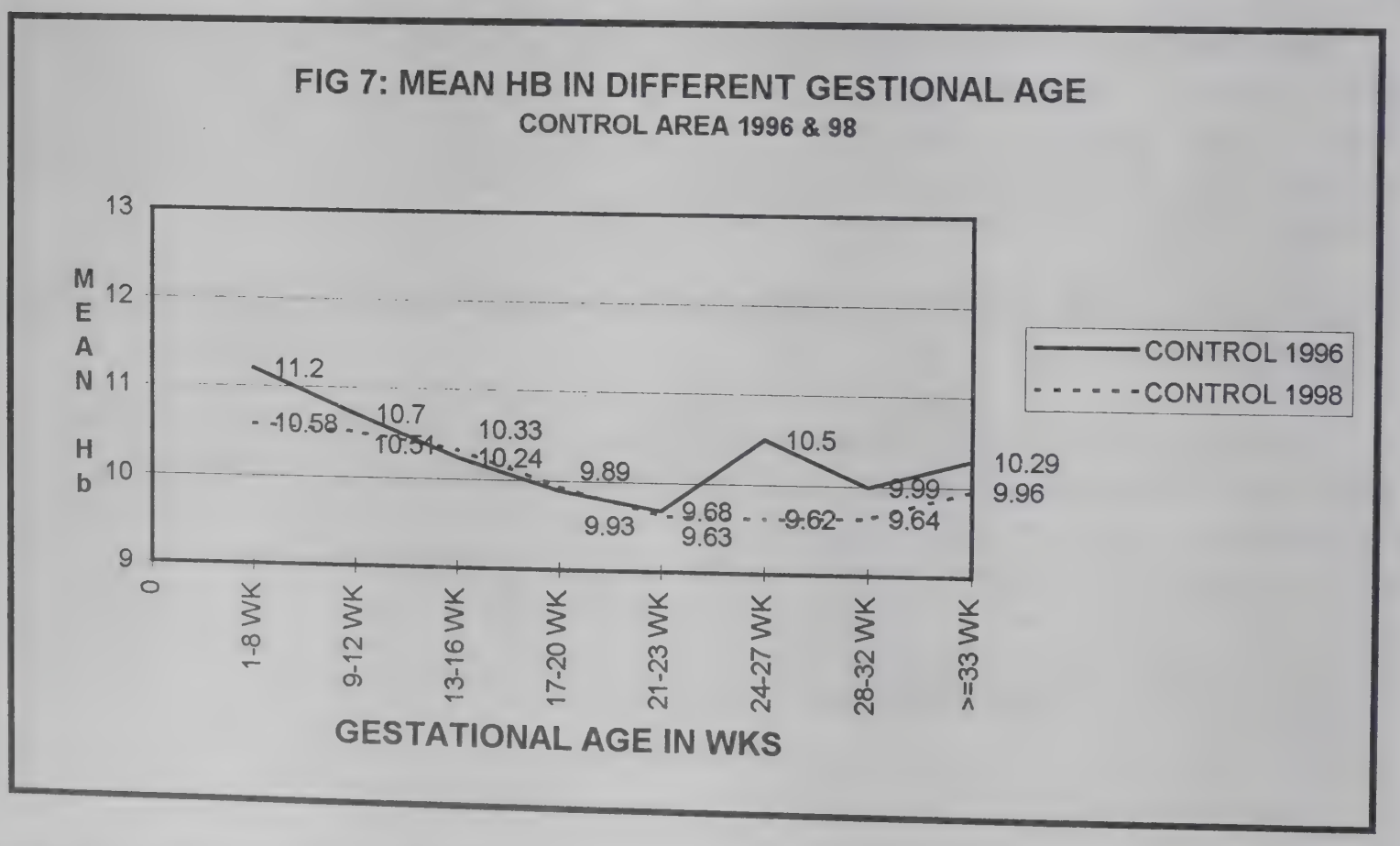
6. PREVALENCE OF ANEMIA AMONG PREGNANT WOMEN OF DIFFERENT TRIMESTERS

Severe anemia in the first trimester was not common in this rural population. In the first trimester moderate anemia prevalence was lower than the mild category and a higher propotion were normal. This trend was observed in the study and control area before and after intervention. However in the second and third trimester, almost same proportion of women are in the moderate, mild and normal before intervention, nevertheless there was a increase from moderate to mild and mild to normal in the study area and a decrease in the control area during 2nd and 3rd trimester.

Among the first trimester women there was a significant (P<0.001) decrease in the prevalence of moderate anemia from 24.4% to 5.6% in the study area and a increase of 7.6% from 25.7% to 33.3% in the control area. The mild anemia prevalence also significantly (P<0.001) reduced from 31.7% to 19.4% in the study area. In the 2nd trimester the moderate anemia significally (P<0.001) decreased from 34.4% to 17.3% and in the 3rd trimester it was from 35.2% to 23.7% in the study area. In the control

6 a. MEAN HB IN DIFFERENT GESTATIONAL AGE





area, both in the mild and moderate anemia during 2nd and 3rd trimesters an increase is observed. Overall there is a significant ($P<0.001$) increase among the normal group in each trimester in the study group after intervention. This is shown in Table 2.11 and Table 2.11a.

A significant ($P<0.001$) increase in the mean hemoglobin concentration was observed in each of the three trimesters in the study area after intervention (Table 2.12).

A significant increase in the mean Hb was observed in each of the gestational weeks in the study area and a non significant decrease was found in the control area (Fig. 6 and Fig. 7).

6 b. DISTRIBUTION OF HB IN PREGNANT WOMEN

The distribution of Hb among pregnant women follows a Gaussian distribution. The shift to the right side in the normal distribution is observed after intervention in the study area and is shown in the fig.8. At the same period there is shift towards left is observed in the control area and is shown in fig.9.

7. SIGNIFICANCE IN THE MEAN HB BEFORE INTERVENTION

The mean Hb was significantly different in the following categories of women in the study area before intervention.

a. The mean Hb of women from forward caste group was significantly higher ($P<0.001$) than those from scheduled caste and those from backward caste.

b. The mean Hb of women who had just one room in their house was significantly ($P<0.05$) lower than those who had two rooms and also those who had more than or equal to three rooms.

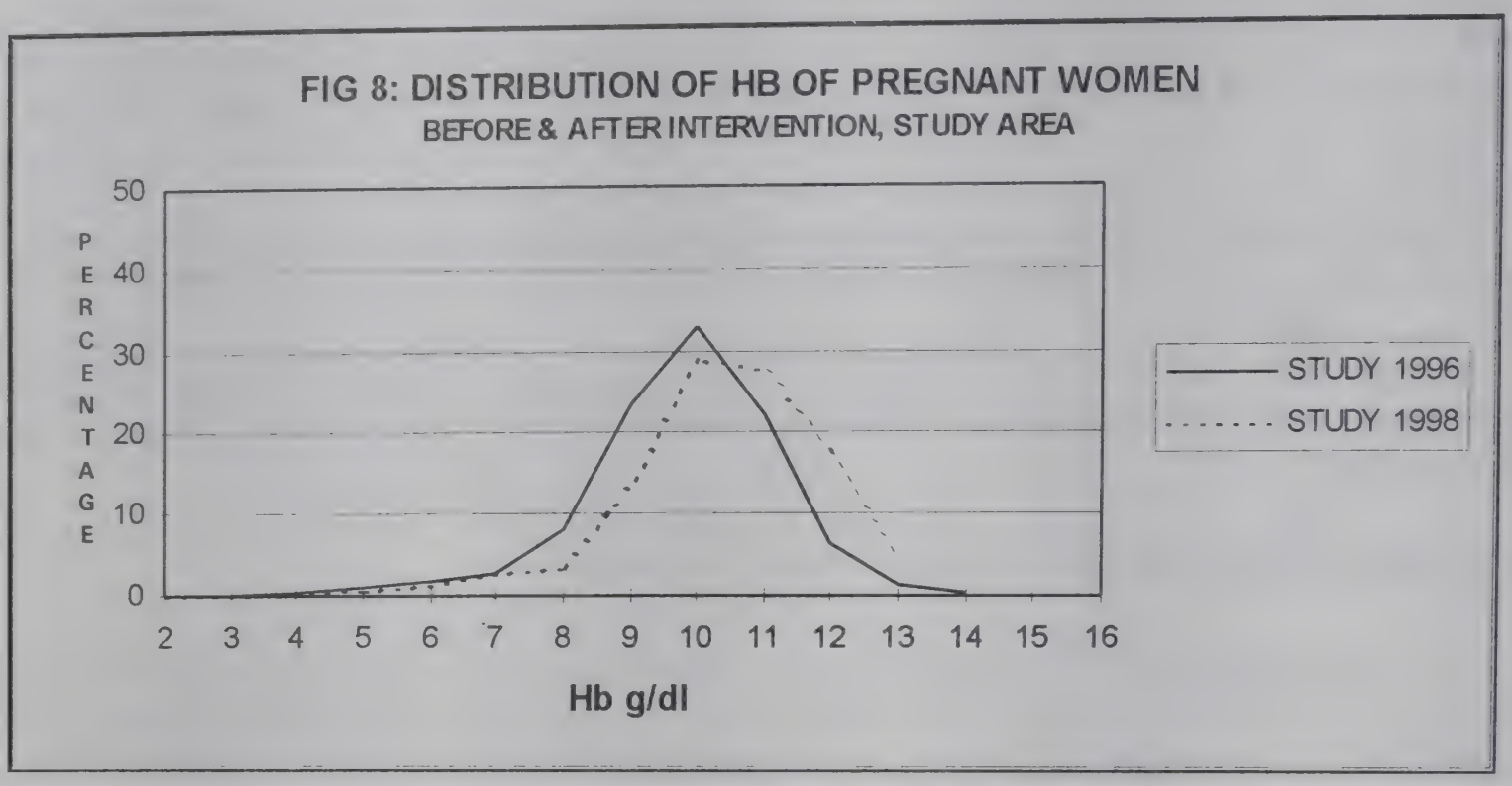
c. The mean Hb of women in their adolescent age group 10-19 years had significantly ($P<0.01$) better than those who were in the age group 20-24 years and more than 24 years.

d. Among those women who had no school education mean Hb was found to be significantly ($P<0.05$) lower than those who had completed 9th standard and above.

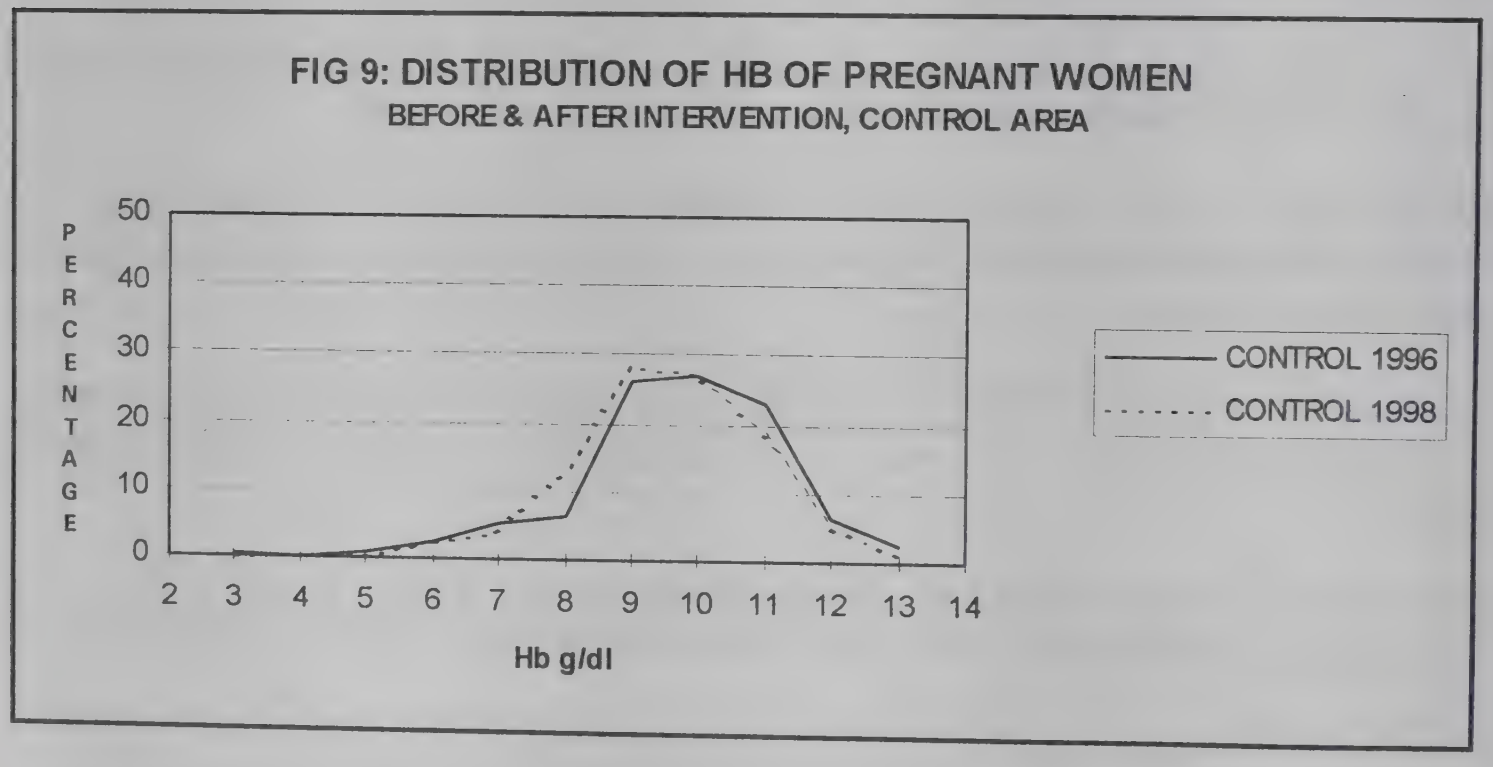
e. Women in the first gravida had significantly ($P<0.001$) higher mean Hb than those who were in the 2nd gravida and those who had equal to 3rd and more gravida ($P<0.01$).

f. The mean Hb level of primi para women was significantly ($P<0.001$) higher than those who were in the first para and those who were in the 2nd and more parity ($P<0.01$).

However none of the variables had its significance in the mean hemoglobin concentration within its group in the control area. This is presented in Table 2.13.



Hb level in g/dl	2	3	4	5	6	7	8	9	10	11	12	13	14
STUDY 1996	0	0	0.4	1.1	1.7	2.6	8	23.5	33	22	6.3	1.3	0.2
STUDY 1998	0	0	0.2	0.7	1.5	2.7	3.2	13.1	28.7	28	17.6	4.2	



Hb level in g/dl	3	4	5	6	7	8	9	10	11	12	13
CONTROL 1996	0.2	0	0.9	2.3	5.3	6.3	26	27.1	23	6.5	2.3
CONTROL 1998	0	0.5	0.5	2.4	3.8	12.9	28	27.5	18.1	5.2	1.2

TABLE 2.1: DECREASE IN PREVALENCE OF ANEMIA (HB <11 g/dl) AMONG PREGNANT WOMEN BEFORE AND AFTER INTERVENTION

HB LEVEL		K.V.Kuppam Study Area	Gudiyatham Control Area	Difference %
Before Intervention	N	464	431	
Hb <11g/dl	No.	326	294	
	%	70.3	68.2	2.1
95% C I		66.1-74.5	63.8-72.6	
After Intervention	N	403	425	
Hb<11g/dl	No.	203	321	
	%	50.4	75.5	25.1 (P<0.001)
95% C I		45.5-55.3	71.3-79.7	18.5-31.7
Difference	%	19.9 (P<0.001)	7.3 (P<0.05)	
95% C I		13.4-26.4	1.3-13.3	

TABLE 2.2: MEAN, STANDARD DEVIATION AND RANGE OF HB AND SF AMONG PREGNANT WOMEN BEFORE AND AFTER INTERVENTION IN THE STUDY AND CONTROL AREA

STATISTICS	K.V. KUPPAM		GUDIYATHAM	
	PRE	POST	PRE	POST
1. HB	n=464	n=403	n=431	n=425
a. Mean	10.16*	10.69*	10.12	9.90
b. SD	1.40	1.49	1.52	1.43
c. Range	4.6-14.1	4.7-13.9	3.0-13.9	4.4-13.2
d.95% C I	10.03-10.29	10.54-10.84	9.98-10.26	9.76-10.04
2. SF	n=260	n=216	n=211	n=223
a. Mean	23.31	25.69	24.45	22.09
b. SD	21.61	19.49	18.78	17.80
c. Range	0.1-153.0	2.5-138.4	1.5-91.3	1.4-115.9
d. 95% C I	20.68-25.99	23.09-28.29	21.92-26.98	19.75-24.43

* P<0.001

TABLE 2.3: COMPARISON OF PREVALANCE OF ANEMIA AMONG PREGNANT WOMEN IN STUDY AND CONTROL AREA BEFORE AND AFTER INTERVENTION

HEMOGLOBIN (g/dl)	K.V. KUPPAM				GUDIYATHAM			
	PRE		POST		PRE		POST	
	No.	%	No.	%	No.	%	No.	%
<7.0 Severe	15	3.2	10	2.5	15	3.5	14	3.3
7.0 - 9.99 Moderate	158	34.1*	77	19.1*	162	37.6	190	44.7
10.0 - 10.99 Mild	153	33.0	116	28.8	117	27.1	117	27.5
≥ 11.0 Normal	138	29.7#	200	49.6#	137	31.8	104	24.5
Total	464	100.0	403	100.0	431	100.0	425	100.0

*, # - P <0.001

TABLE 2.4: PREVALENCE OF IRON DEFICIENCY USING DIFFERENT SF CUT OFF AMONG PREGNANT WOMEN BEFORE AND AFTER INTERVENTION

SF Cut off At	Before Intervention	After Intervention	Differ-ence	Sig Level
1. < 11.99 µg/L				
Study	39.2	27.3	11.9	P<0.01
Control	32.7	35.4	2.7	NS
2. < 14.99 µg/L				
Study	47.7	35.2	12.5	P<0.01
Control	42.7	43.5	0.8	NS
3. < 19.99 µg/L				
Study	58.1	49.1	9.0	P< 0.05
Control	52.1	55.2	3.1	NS
4. < 23.99 µg/L				
Study	65.0	56.9	8.1	NS
Control	59.2	66.8	7.6	NS

TABLE 2.5: COMPARISON OF PREVALENCE OF IRON DEFICIENCY (SF) AMONG PREGNANT WOMEN BEFORE AND AFTER INTERVENTION

SERUM FERRITIN (µg/L)	STUDY AREA				CONTROL AREA			
	PRE		POST		PRE		POST	
	No.	%	No.	%	No.	%	No.	%
< 11.99	102	39.2	59	27.3	69	32.7	79	35.4
12 - 14.99	22	8.5	17	7.9	21	10.0	18	8.1
15 - 19.99	27	10.4	30	13.9	20	9.5	26	11.7
≥ 20.00	109	41.9	110	50.9	101	47.8	100	44.8
Total	260	100.0	216	100.0	211	100.0	223	100.0

TABLE 2.6 : IRON DEFICIENCY STATUS OF PREGNANT WOMEN BEFORE INTERVENTION

CATEGORY	STUDY AREA NO.	% n=254	CONTROL AREA NO.	% n=211
1. HB >11 g/dl SF >12 µg/L No iron deficiency	61	24.02*	56	26.54
2. HB >11 g/dl SF <12 µg/L Storage Depletion	17	6.69	16	7.58
3. HB <11 g/dl SF <12 µg/L Iron deficiency Anemia	84	33.07$	53	25.12
4. HB <11 g/dl SF >12 µg/L Other causes of anemia	92	36.22#	86	40.76

TABLE 2.7: IRON DEFICIENCY STATUS OF PREGNANT WOMEN AFTER INTERVENTION

CATEGORY	STUDY AREA NO.	% n=216	CONTROL AREA NO.	% n=223
1. HB >11 g/dl SF >12 µg/L No iron deficiency	100	46.3*	42	18.8
2. HB >11 g/dl SF <12 µg/L Storage Depletion	14	6.5	8	3.6
3. HB <11 g/dl SF <12 µg/L Iron deficiency Anemia	45	20.8$	71	31.8
4. HB <11 g/dl SF >12 µg/L Other causes of anemia	57	26.4#	102	45.7

* P <0.001, $ P <0.01, # P <0.05

TABLE 2.8 : PREVALENCE OF ANEMIA (HB < 11.0 g/dl) IN DIFFERENT SOCIO ECONOMIC GROUPS BEFORE AND AFTER INTERVENTION IN THE STUDY AND CONTROL AREA

SOCIO ECONOMIC VARIABLES	HB <11 g/dl STUDY AREA PRE No.	%	STUDY AREA POST No.	%	CONTROL AREA PRE No.	%	CONTROL AREA POST No.	%
1. ROOF								
Thatched	164	73.2	84	54.2	154	69.1	167	78.8
Tiled	88	68.8	64	47.4	83	66.4	92	74.8
Terraced	74	66.1	55	48.7	57	68.7	62	68.9
2. LATRINE								
No	287	69.3	175	50.0	282	68.4	272	75.1
Yes	39	78.0	28	52.8	12	63.2	49	77.8
3. NO. OF ROOMS								
One Room	152	76.0	93	50.3	110	65.5	190	76.9
Two Rooms	101	67.3	74	53.2	132	69.5	92	74.2
≥ Three Rooms	73	64.0	36	45.6	52	71.2	39	72.2
4. LAND OWNERSHIP								
0.0-0.50 Cents	248	71.7	164	50.3	218	68.6	288	76.0
≥ 0.51 Cents	78	66.1	39	50.6	76	67.3	33	71.7
5. TYPE OF FAMILY								
Nuclear	165	74.3	89	54.9	113	66.1	154	75.9
Extended	43	67.2	60	53.1	70	72.2	74	69.2
Joint	118	66.3	54	42.2	111	68.5	93	80.9

SOCIO ECONOMIC VARIABLES	HB <11 g/dl STUDY AREA PRE No.	%	STUDY AREA POST No.	%	CONTROL AREA PRE No.	%	CONTROL AREA POST No.	%
6. FAMILY SIZE								
1-4 Persons	167	69.0	112	53.8	132	67.0	162	72.6
5-7 Persons	119	72.6	68	46.9	124	70.9	115	77.7
8-15 Persons	40	69.0	23	46.0	38	64.4	44	81.5
7. EDUCATION								
0-5th Std	181	72.4	91	58.3	176	68.8	199	81.2
6-8th Std	88	72.1	59	49.2	70	66.7	69	71.1
Above 9th Std	57	62.0	53	41.7	48	68.6	53	63.9
8. OCCUPATION								
Cooli	63	82.9	47	58.0	93	73.8	51	75.0
House Wife/ House work	234	68.2	143	48.1	189	67.0	245	75.2
Aya/Match, Shoe companies/Beedi/ Petti business	29	64.4	13	52.0	12	52.2	25	80.6
9. HUSBANDS EDUCATION								
0-5th Std	127	73.0	81	56.3	154	70.6	149	79.3
6-8th Std	90	75.0	43	48.3	66	62.3	77	72.0
Above 9th Std	109	64.1	79	46.5	74	69.2	95	73.1

TABLE 2.9: PREVALENCE OF ANEMIA (HB <11 g/dl) AMONG PREGNANT WOMEN WITH DIFFERENT OBSTETRIC CHARACTERISTICS

OBSTETRIC VARIABLES	HB <11 g/dl STUDY AREA				CONTROL AREA			
	PRE		POST		PRE		POST	
	No.	%	No.	%	No.	%	No.	%
1. AGE								
14 - 19	82	62.1	35	49.3	69	65.1	53	77.9
20 - 24	155	72.4	98	47.8	145	71.1	167	72.3
25 - 29	75	75.0	53	50.5	56	62.9	70	79.5
30 - 44	14	77.8	17	77.3	24	75.0	31	81.6
2. AGE AT MENARCHE								
10 - 12 Yrs	10	76.9	10	58.8	12	92.3	50	80.6
13 Yrs	50	76.9	32	61.5	36	59.0	79	68.7
14 Yrs	118	63.4	66	50.0	144	70.6	92	76.7
15 Yrs	90	73.8	75	49.3	70	65.4	71	78.0
16 - 23 Yrs	58	74.4	20	40.0	32	69.6	29	78.4
3. AGE AT MARRIAGE								
10 - 15 Yrs	40	71.4	10	52.6	33	68.8	29	80.6
16 - 19 Yrs	209	68.8	124	52.5	208	68.6	208	74.6
20 - 30 Yrs	77	74.0	69	46.6	53	66.3	84	76.4
4. AGE AT FIRST PREGNANCY								
12 - 19 Yrs	208	68.9	100	50.5	185	67.8	171	76.0
20 - 24 Yrs	102	71.8	93	50.3	98	69.5	130	74.3
25 - 35 Yrs	16	80.0	10	50.0	11	64.7	20	80.0
5. GESTATIONAL AGE								
1 - 12 Wks	23	56.1	9	25.0	20	57.1	14	46.7
13 - 27 Wks	160	73.4	94	49.2	104	65.8	174	76.0
28 & above	137	68.9	100	56.8	136	70.1	133	80.1
No information	6	100.0	-	-	34	77.3	-	-

OBSTETRIC VARIABLES	HB <11 g/dl STUDY AREA PRE No.	%	STUDY AREA POST No.	%	CONTROL AREA PRE No.	%	CONTROL AREA POST No.	%
6. GRAVIDA								
One	103	62.8	64	47.8	99	67.3	116	74.8
Two	121	75.6	73	49.3	83	69.2	96	78.0
Three	56	70.9	40	55.6	55	66.3	66	73.3
Above 4	46	75.4	26	53.1	57	70.4	43	75.4
7. PARITY								
First Pregnancy	113	62.1	77	48.1	107	66.0	127	75.6
One	124	78.0	66	47.1	85	69.7	101	75.4
Two	53	70.7	39	56.5	51	65.4	55	73.3
Above Three	36	75.0	21	61.8	51	73.9	38	79.2
8. ABORTION								
No Abortion	295	71.1	177	51.0	268	69.6	297	75.8
1 - 3	31	63.3	26	46.4	26	72.2	24	72.7
9. STILL BIRTH								
No still birth	318	70.4	202	50.6	282	68.4	309	75.9
1 - 3	8	66.7	1	25.0	12	66.7	12	66.7
10. NO. OF CHILDREN DIED								
No Death	297	70.0	180	49.3	265	67.8	298	76.0
1 - 3	29	72.5	23	60.5	29	72.5	23	69.7
11. NO. OF CHILDREN LIVING								
No Children	122	62.6	89	47.6	111	64.5	142	76.3
1-2 Children	176	74.6	98	51.6	145	70.7	148	74.0
3-7 Children	28	84.8	16	61.5	38	70.4	31	79.5

TABLE 2.10: PREVALENCE OF ANEMIA (HB <11 g/dl) AMONG PREGNANT WOMEN WITH DIFFERENT NUTRITIONAL STATUS GROUPS BEFORE INTERVENTION

NUTRITIONAL VARIABLES	STUDY AREA		CONTROL AREA	
	HB <11 g/dl			
	No.	Prevalence(%)	No.	Prevalence(%)
1. HEIGHT				
≤ 144.9	24	85.7	32	65.3
145.0-149.9	68	73.9	93	69.4
≥ 150.0	234	68.0	169	68.1
2. WEIGHT				
≤ 37.9	23	82.1	38	66.7
38.0-39.9	20	74.1	21	61.8
40.0-44.9	89	72.4	100	69.0
≥ 45.0	194	67.8	135	69.2
3. ARM CIRCUMFERENCE				
≤ 22.9	84	73.0	93	72.1
≥ 23.0	242	69.3	201	66.6
4. BMI				
13.6-16.00	9	81.8	16	61.5
16.01-17.00	27	71.1	24	55.8
17.01-18.50	63	70.0	70	74.5
18.51-20.00	32	88.9	27	77.1
20.01-25.00	182	67.9	150	68.2
25.01-30.00	13	61.9	7	63.6

TABLE 2.11: PREVALENCE OF ANEMIA (HB <11g/dl) IN THE THREE TRIMESTERS BEFORE INTERVENTION

Hb Level	STUDY AREA						CONTROL AREA					
	1-12 Wks		13-27 Wks		≥28 Wks		1-12 Wks		13-27 Wks		≥28 Wks	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0.01- 6.99	-	-	8	3.7	6	3.0	-	-	9	5.7	5	2.6
		*										
7.00- 9.99	10	24.4	75	34.4	70	35.2	9	25.7	58	36.7	75	38.7
		$										
10.00-10.99	13	31.7	77	35.3	61	30.7	11	31.4	37	23.4	56	28.9
		#		#		#		!		+		~
> 11.00	18	43.9	58	26.6	62	31.2	15	42.9	54	34.2	58	29.9
		@		@								
TOTAL	41	100.0	218	100.0	199	100.0	35	100.0	158	100.0	194	100.0

TABLE 2.11a : PREVALENCE OF ANEMIA (HB < 11g/dl) IN THREE TRIMESTERS AFTER INTERVENTION

Hb Level	STUDY AREA						CONTROL AREA					
	1-12 Wk		13-27 Wk		≥28 Wk		1-12 Wk		13-27 Wk		≥28 Wk	
No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
0.01-6.99	-	-	3	1.6	7	4.0	-	0.0	5	2.2	9	5.4
		*										
7.00-9.99	2	5.6	33	17.3	42	23.7	10	33.3	112	48.9	68	41.0
		$										
10.00-10.99	7	19.4	58	30.4	51	28.8	4	13.3	57	24.9	56	33.7
		#		#		#		!		+		~
> 11.00	27	75.0	97	50.8	77	43.5	16	53.3	55	24.0	33	19.9
		?		?								
Total	36	100.0	191	100.0	177	100.0	30	100.0	229	100.0	166	100.0

*, $, # - Sig level between Pre & Post, Study area.
!, +, ~ - Sig level between Pre & Post, Control area.
@, ?, - Sig level between 1st & 2nd trimester in study area

#, *, - P<0.001 ? - P<0.01 $, @, ! - NS +, | P<0.05

Table 2.12: MEAN, SD AND RANGE OF HB IN TRIMESTERS IN STUDY AREA

Gestational Age	Before			After			Sig Level
	N	Mean	SD	N	Mean	SD	
I Trimester	41	10.51	1.17	36	11.36	0.83	P<0.001
II Trimester	218	10.16	1.34	191	10.75	1.40	P<0.001
III Trimester	199	10.13	1.47	177	10.49	1.63	P<0.001

TABLE 2.13: MEAN, SD OF HB AMONG DIFFERENT GROUPS BEFORE INTERVENTION IN STUDY AND CONTROL AREAS

VARIABLES	K.V.KUPPAM			SIG	GUDIYATHAM		
	N	MEAN	SD	LEVEL	N	MEAN	SD
1. CASTE							
SC	139	10.05	1.35	P<0.001 (1&3)	149	10.11	1.53
BC	291	10.12	1.42	P<0.001 (2&3)	264	10.10	1.53
FC	34	10.98	1.21		18	10.49	1.35
2. TYPE OF ROOF							
Thatched	224	9.98	1.44		223	10.06	1.54
Tiled	128	10.36	1.41		125	10.17	1.56
Terraced	112	10.29	1.27		83	10.20	1.38
3. NO.OF ROOMS							
One Room	200	9.95	1.45		168	10.16	1.49
Two Rooms	150	10.31	1.36	P<0.05 (1&2)	190	10.13	1.54
≥ 3 Rooms	114	10.33	1.33	P<0.05 (1&3)	73	9.99	1.55
4. AGE							
10 - 19	132	10.48	1.10		106	10.34	1.46
20 - 24	214	10.03	1.45	P<0.01 (1&2)	204	10.06	1.50
≥ 25	118	10.03	1.55	P<0.01 (1&3)	121	10.04	1.55
5. EDUCATION							
No Edn	115	10.00	1.39		162	10.09	1.52
1 - 5th	135	10.14	1.39		94	9.97	1.68
6th-8th	122	10.14	1.39		105	10.27	1.36
≥ 9th	92	10.42	1.42	P<0.05 (1&4)	70	10.19	1.53

VARIABLES	K.V.KUPPAM N	MEAN	SD	SIG LEVEL	GUDIYATHAM N	MEAN	SD
6. GRAVIDA							
1	164	10.48	1.18		147	10.26	1.52
2	160	9.98	1.46	P<0.001 (1&2)	120	10.08	1.54
≥ 3	140	9.99	1.51	P<0.01 (1&3)	164	10.02	1.50
7. PARITY							
0	182	10.45	1.25		162	10.28	1.53
1	159	9.94	1.42	P<0.001 (1&2)	122	10.07	1.52
≥ 2	123	10.02	1.52	P<0.01 (1&3)	147	10.00	1.50
8. LIVING CHILDREN							
No Living Child	195	10.41	1.27		172	10.31	1.53
1 Living Child	162	9.97	1.40	P<0.01 (1&2)	129	10.03	1.53
≥ 2	107	9.99	1.56	P<0.05 (1&3)	130	9.96	1.47
9. SPACING							
1-12 Mths	79	9.87	1.47		60	10.06	1.54
13-24 Mths	110	9.97	1.61		129	9.95	1.51
≥ 25 Mths	102	10.02	1.36		93	10.15	1.56
10. HEIGHT							
≤ 144.9	28	9.63	1.48		49	10.13	1.47
145.0-149.9	92	10.07	1.35		134	10.07	1.56
≥ 150.0	344	10.23	1.40		248	10.15	1.51
11. WEIGHT							
≤ 37.9	28	10.26	0.90		57	10.28	1.37
38.0-39.9	27	9.97	1.33		34	10.24	1.59
40.0-44.9	123	10.16	1.33		145	9.97	1.59
≥ 45.0	286	10.17	1.48		195	10.17	1.50

VARIABLES	K.V.KUPPAM N	MEAN	SD	SIG LEVEL	GUDIYATHAM N	MEAN	SD
12. ARM CIRCUMFERENCE							
≤ 22.9	114	10.15	1.26		129	10.06	1.55
≥ 23.0	349	10.18	1.42		302	10.15	1.51
13. BMI							
≤ 18.49	138	10.16	1.36		164	10.15	1.53
≥ 18.50	326	10.16	1.42		267	10.10	1.52

DETERMINANTS OF ANEMIA AMONG PREGNANT WOMEN

Univariate analysis was done to find out the correlating variables with hemoglobin values. This is presented in Table 2.14.

Hemoglobin concentration had significant negative correlation ($P < 0.01$) with family income, gravida, parity and number of living children and highly significant positive correlation ($P < 0.001$) with arm circumference. Serum ferritin concentration had significant ($P < 0.01$) positive correlation with height of the pregnant women. The above correlations were observed in the study area before intervention. In the control area none of the variables correlated with hemoglobin concentration.

During the post intervention survey, women's education was positively correlated ($P < 0.001$), number of living children was negatively correlated ($P < 0.01$) and gestational age was negatively correlated ($P < 0.001$) in the study area. Women's education and spacing was positively correlated ($P < 0.001$) and women's age was negatively correlated ($P < 0.01$) in the control area.

Hb is highly positively correlated with SF, indicating iron deficiency is the main cause for nutritional anemia. This is observed among the pregnant women in the study ($P < 0.001$) and control block ($P < 0.001$) before intervention and both data pooled together ($P < 0.001$). After intervention there is no correlation observed between HB & SF in the study area. But in the control area there was positive correlation ($P < 0.001$). The impact made by increasing the hemoglobin concentration in the study area made this correlation absent.

As the study and control groups had the same socio economic characteristics with the same prevalence of anemia and with no statistical differences, the data of both the blocks were pooled together to see the factors that are correlating with, Hb. Gravida, parity, number of living children were negatively highly significantly ($P<0.001$) correlated with hemoglobin concentration. Arm circumference ($P<0.001$) had positive correlation with Hb before intervention. Women's education and husband's education are positively correlated and were significant ($P <0.001$). Age, parity, number of living children, gestational age are negatively correlated ($P < 0.001$) after intervention.

Multivariate regression analysis was carried out to find out the factors explaining the hematological status of pregnant women. The result is presented in Table 2.15. The factors explaining the dependent variables Hb and SF before intervention is detailed in the baseline report.

After the intervention, in the socio economic factors model, education of women is the variable predicting Hb levels explaining for 4.1% in K.V.Kuppam block, where as number of rooms and education of the women were explained by 4.2% in Gudiyatham block. In the demographic factors model women's age and age at menarche are explaining for 2.2% in the study area. Women's age and family size are explaining for 3.0% in the control area. In the obstetric factors model gestational age is the variable that explains for 4.9% of variation in Hb level in the study area and 2.6% in the control area.

When socio economic model, demographic model and obstetric model are combined together, gestational age and education of women were explained by 8.9% in K.V. Kuppam block. Number of rooms, education of women, family size, women's age and gestational age are the explanatory variables accounting for 8.4% in the control area.

PREVALENCE OF HOOKWORM

The prevalence of hookworm is shown in Table 2.16. The presence of hookworm ova in the stool of pregnant women was not assessed before the intervention. However the assessment was made after the intervention both in the intervention area and the control area. A total of 111 samples from K.V. Kuppam block and 42 from Gudiyatham block were collected. Only 13.5% had hook worm ova in the intervention area and 47.6% had in the control area and the difference in the hookworm ova prevalence is statistically significant ($P<0.001$).

INEFFECTIVENESS OF CLINICAL SIGNS IN DIAGNOSIS OF ANEMIA

During the baseline we attempted to test the effectiveness of clinical signs and symptoms of anemia. The clinical sign of pallor did not relate well with severe anemia. Since we were convinced that only laboratory tests can diagnose anemia this was not used in the post evaluation.

TABLE 2.14: CORRELATION BETWEEN HB, SF AND SOCIO ECONOMIC AND OBSTETRIC VARIABLES

	PRE INTERVENTION			POST INTERVENTION		
	Study N=464	Control N=433	Both N=895	Study N=409	Control N=425	Both N=827
HB with						
1. Income	-.1215 *	-	-	- **	- *	- **
2. Women Education	-	-	-	.1868	.1590 *	.2126 **
3. Age	-	-	-	-	-.1525 *	-.1166 **
4. Husband Education	-	-	-	-	-	.1161 **
1. Gravida	-.1418 *	-	-.1482 **	-	-	- **
2. Parity	-.1431 *	-	-.1219 **	- *	-	-.1148 **
3. No of Living Children	-.1488	-	-.1236	-.1396	- *	-.1307
4. Spacing	-	-	-	- **	.1542	- **
5. Gestational Age	-	-	-	-.1686	-	-.1291
1. Arm circum-ference	.1924 **	-	.1191 **	-	-	-
SF with						
Height	.1352 *	-	.0822 *	-	-	-
HB with SF	.3898 **	.2506 **	.3016 **	.1538	.3788 **	.3441 **

* - P <0.01 ** - P < 0.001

TABLE 2.15:DETERMINANTS OF ANEMIA AMONG PREGNANT WOMEN

PARTICULARS	PRE INTERVENTION	POST INTERVENTION
A. STUDY AREA		
1. Socio Economic Factors Model	1. Monthly income 2. Caste (R^2 = 5.1%)	1. Education of women (R^2=4.1%)
2. Demographic Factors	1. Women's Age (R^2=1.2%)	1. Women's Age 2. Age at Menarche (R^2=2.2%)
3. Nutritional Factors Model	1. Maternal Height 2. Maternal Weight 3. Arm circumference 4. BMI (R^2 = 6.2%)	Not Obtained
4. Obstetric Factors Model	1. No.of Liv children (R^2=2.7%)	1.Gestational Age (R^2=4.9%)
5. Combined Factors Model	1. Caste 2. Monthly income 3. Maternal Height 4. Maternal Weight 5. Arm circumference 6. BMI 7. Living Children (R^2 = 12.1%)	1. Gestational Age 2. Education of Women (R^2 = 8.9%)
B. CONTROL AREA		
1. Socio Economic Factors Model	1. No. of Rooms (R^2 = 1.8%)	1. No. of Rooms 2. Education of women (R^2=4.2)
2. Demographic Factors Model	None	1. Women's Age 2. Family Size (R^2=3.0)
3. Nutritional Factors	None	Not Obtained
4. Obstetric Factors Model	1.Still Birth (R^2=2.3)	1. Gestational Age (R^2 = 2.6%)
5. Combined Factors Model	1. No. of Rooms (R^2 = 4.4%)	1. No. of Rooms 2. Education of women 3. Family Size 4. Women's Age 5. Gestational Age (R^2 = 8.4%)

TABLE 2.16: PREVALENCE OF HOOK WORM OVA IN STOOLS AMONG PREGNANT WOMEN AFTER INTERVENTION

Evaluation		K.V.Kuppam Study	Gudiyatham Control	Sig Level
Pre Intervention		N A	N A	
Post Intervention	N	111	42	
Presence of	No.	15	20	
Hookworm	%	13.5	47.6	P<0.001

3. KNOWLEDGE INCREASE AND CHANGES IN PRACTICE

a. KNOWLEDGE

Of the 409 pregnant women interviewed, after intervention in K.V.Kuppam block 334 women stayed more than three months in this block and their gestational age was more than 12 weeks. The rest of them had moved to this intervention area during different gestational ages of their pregnancy period. There were 180 pregnant women who had stayed more than one month and were in their 3rd trimester. There were 155 pregnant women who had stayed more than 3 months and in the 3rd trimester. The prevalence of anemia did not vary much in the different groups.

The impact of IEC varies depending on their duration of stay in the intervention area as the intensity is targeted mainly to pregnant women. First analysis was done to see the impact made in the increase of their knowledge including all women interviewed. This was basically to compare with the control group and with the pre intervention data as the subjects are the general group of pregnant women irrespective of their duration of stay and gestational age. The second analysis was done including the women who had their stay in the intervention area having minimum of 3 months stay. This was mainly to assess the process that went into in reaching the pregnant women to disseminate the IEC component.

Table 3.1 presents the significant change that was made in the knowledge level of pregnant women of the intervention area in comparison with the control area. Eye pallor, tongue pallor, whiteness in the lips or nail bed, spoon shaped nail and tiredness were stated as symptoms of anemia by a significant percentage ($P < 0.001$) of women in the intervention area compared to the control area.

Of the causes of anemia low iron intake, hook worm infestation and frequent pregnancy or less spacing were significantly ($P < 0.001$) stated by a higher percentage of women in the intervention area. The difference in the knowledge of anemia regarding its consequences, as low birth weight of the baby, maternal death, and still birth was highly significant ($P < 0.001$) between the intervention and control area and abortion was significant ($P < 0.05$).

Increased food consumption during pregnancy to prevent anemia was stated by 95.6% of the women in the intervention and 57.1% in the control area and the difference is found to be highly significant ($P < 0.001$). Iron consumption and consuming food that enhances iron to prevent anemia were stated by a significantly higher percentage of women in the intervention area in comparison to the control. A significant difference was observed between proportion of women with the knowledge of foods that enhances iron absorbtion as amaranth, lemon or orange, cabbage, raw tomato($P < 0.001$) and fresh guava ($P < 0.05$).

Little less than half the pregnant women (44.7%) knew that taking either tea or coffee soon after the meal inhibits iron absorbtion into the body in the intervention area. However in the control area it was almost nil.

A significant ($P < 0.001$) percentage of women knew that hook worm enters into the body through feet, hookworm sucks blood while it is in the body, wearing slippers while going out will prevent hook worm infestation in comparison with the control area. That deworming prevents anemia was not known in both the areas. This could be because the IEC strategies did not concentrate on this fact compared to the importance given to other facts.

The difference in the proportion of pregnant women having no knowledge on each of the fact on anemia is highly significant ($P < 0.001$) between the intervention and control area.

Table 3.2 reveals the retention of knowledge that was received through the IEC component. In the control area, very few pregnant women were able to say more than 3 symptoms of anemia whereas in the intervention area one fourth of them were able to say four symptoms of anemia. Surprisingly, there were few women who were able to say all the four causes of anemia, five consequences of anemia, four ways of preventing anemia, five food stuffs that enhances iron absorbtion into the body in the intervention area. A considerable proportion were able to say more than one of each fact of anemia. This is an indication that messages that are well framed and specific, if it is transferred repeatedly through many strategies, yields an effective result.

Knowledge on the Iron Folate tablet (IFA) consumption to prevent anemia during pregnancy, taking one IFA per day with duration of 5th to 9th month, increased in the intervention area after intervention but remained almost the same in the control area. In the intervention area, RUHSA health centre, mobile clinics run by RUHSA in different peripheral service units of the block, VHNs (Government) and private practitioners are the sources of IFA known where as in the control area, 61.8% stated VHNs as the source for IFA followed by Government PHC, RUHSA health centre and private.

Only about 10% of the women in the intervention and control areas before and after intervention stated GIT upset, nausea or vomiting, black stool and indigestion as the side effects of IFA tablets. Of these GIT upset and black stools were stated by more than 5% of the women where as nausea or vomiting and indigestion were stated by only less than 2% of the women.

Table 3.1: KNOWLEDGE LEVEL OF PREGNANT WOMEN IN THE STUDY AND CONTROL AREA AFTER INTERVENTION - COMPARISON

KNOWLEDGE	KV KUPPAM		GUIDYATHAM		SIGNIFICANCE LEVEL
	No.	% n=409	No.	% n=464	
1. Definition of Anemia	199	48.7	14	3.0	P< 0.001
2. Signs & Symptoms					
Eye Pallor	303	74.1	131	28.2	P< 0.001
Tongue Pallor	217	53.1	29	6.3	P< 0.001
Whiteness of Lips	156	38.1	11	2.4	P< 0.001
Whiteness in nail bed	152	37.2	28	6.0	P< 0.001
Spoon shaped nail	109	26.7	5	1.1	P< 0.001
Tiredness	210	51.3	64	13.8	P< 0.001
Breathlessness	26	6.4	14	3.0	N S
Don't Know	55	13.4	282	60.8	P< 0.001
3. Causes					
Low iron intake	390	95.4	210	45.3	P< 0.001
Hook worm Infestation	69	16.9	1	0.2	P<0.001
Early marriage	108	26.4	12	2.6	N S
Frequent Pregnancy/ Less spacing	57	13.9	4	0.9	P< 0.001
Don't Know	17	4.2	244	52.6	P< 0.001
4. Consequences					
Low Birth Weight	251	61.4	83	17.9	P< 0.001
Maternal Death	103	25.2	15	3.2	P< 0.001
Preterm Delivery	102	24.9	93	20.0	N S
Abortion	114	27.9	26	5.6	P< 0.05
Still Birth	168	41.1	44	9.5	P< 0.001
Don't Know	87	21.3	267	57.5	P< 0.001
5. Prevention					
IFA Consumption	167	40.8	41	8.8	P< 0.001
Increase food consumption	391	95.6	265	57.1	P< 0.001
Consuming Iron enhancer	80	19.6	19	4.1	P< 0.001
Avoid Iron Inhibitors	3	0.7	0	0.0	N S
Deworming	2	0.5	0	0.0	
Don't Know	7	1.7	170	36.6	P< 0.001

6. Iron Enhancers					
Amaranth	249	60.9	74	15.9	P< 0.001
Lemon/Orange	151	36.9	6	1.3	P< 0.001
Cabbage	40	9.8	4	0.9	P< 0.001
Fresh Guava	11	2.7	4	0.9	P< 0.05
Raw Tomato	2	0.5	3	0.6	NS
Don't Know	149	36.4	401	86.4	P< 0.001
7. Food Inhibitors					
Tea/Coffee	183	44.7	2	0.4	P< 0.001
Don't Know	226	55.3	462	99.6	P< 0.001
8. Hook Worm Entrance					
Through Feet	214	52.3	6	1.3	P< 0.001
Through Skin	4	1.0	2	0.4	N S
Don't Know	191	46.7	456	98.3	P< 0.001
9. What it Does					
Sucks Blood	216	52.8	12	2.6	P< 0.001
Don't Know	193	47.2	452	97.4	P< 0.001
10. Prevention of HW					
Deworming	11	2.7	12	2.6	N S
Wear Slippers	140	34.2	13	2.8	P< 0.001
Deworming & wear slippers	67	16.4	0	0.0	P< 0.001
Don't Know	191	46.7	439	94.6	P< 0.001

During pre evaluation more than 98% of the pregnant women did not answer these questions due to lack of clarity in the questions asked.

TABLE 3.2: KNOWLEDGE INCREASE ABOUT FACTS OF ANEMIA AMONG PREGNANT WOMEN - COMPARISON BETWEEN STUDY AND CONTROL AREA

KNOWLEDGE	KV KUPPAM BLOCK				GUIDYATHAM BLOCK			
	PRE		POST		PRE		POST	
	No.	% n=522	No.	% n=409	No.	% n=510	No.	% n=464
1. Definition of Anemia	-	-	199	48.7	0	0.0	14	3.2
2. Signs & Symptoms								
Don't Know	-	-	55	13.4	-	-	282	60.8
One Symptom	-	-	57	13.9	-	-	102	22.0
Two Symptoms	-	-	82	20.0	-	-	62	13.4
Three Symptoms	-	-	54	13.2	-	-	16	3.5
Four Symptoms	-	-	161	39.4	-	-	2	0.4
Five Symptoms	-	-	51	12.5	-	-	0	0.0
Six Symptoms	-	-	34	8.3	-	-	0	0.0
Seven Symptoms	-	-	9	2.2	-	-	0	0.0
3. Causes								
Don't Know	-	-	17	4.2	-	-	244	52.6
One cause	-	-	229	56.0	-	-	214	46.1
Two Causes	-	-	103	25.2	-	-	5	1.1
Three Causes	-	-	49	12.0	-	-	1	0.2
Four Causes	-	-	11	2.7	-	-	0	0.0
4. Consequences								
Don't Know	-	-	87	21.3	-	-	267	57.5
One Consequence	-	-	85	20.8	-	-	139	30.0
Two Consequences	-	-	107	26.2	-	-	51	11.0
Three Consequences	-	-	130	31.8	-	-	7	1.5
Four Consequences	-	-	39	9.5	-	-	0	0.0
Five Consequences	-	-	5	1.2	-	-	0	0.0
5. Prevention								
Don't Know	-	-	7	1.7	-	-	170	36.6
One Prevention	-	-	161	39.4	-	-	260	56.0
Two Preventions	-	-	241	58.9	-	-	33	7.1
Three Preventions	-	-	75	18.3	-	-	0	0.0
Four Preventions	-	-	9	2.2	-	-	0	0.0

6. Enhancers								
One enhancer	-	-	67	16.4	-	-	57	12.3
Two enhancers	-	-	193	47.2	-	-	28	6.0
Three enhancers	-	-	65	15.9	-	-	0	0.0
Four enhancers	-	-	70	17.1	-	-	0	0.0
Five enhancers	-	-	3	0.7	-	-	0	0.0
7. Awareness IFA	458	87.7	368	90.0	411	80.6	278	59.9
8. Dosage								
1 IFA Tab	343	65.7	330	80.7	294	57.6	247	53.2
2 IFA Tabs	76	14.6	23	5.6	99	19.4	76	16.4
3 IFA Tabs	12	2.3	1	0.2	12	2.3	8	1.7
Don't Know	91	17.4	55	13.4	105	20.6	133	28.7
9. Duration								
< 5 Months	54	10.3	0	0.0	55	10.8	0	0.0
5-9 Months	334	64.0	345	84.4	309	60.0	303	65.3
Don't Know	134	25.7	64	15.6	149	29.2	161	34.7
10.Sources of IFA								
One Place	224	42.9	241	58.9	319	62.6	300	64.7
Two Places	171	32.8	56	13.7	76	14.9	12	2.6
Three Places	43	8.2	56	13.7	15	2.9	4	0.9
≥ Four Places	20	3.8	19	4.6	0	0.0	0	0.0
Don't Know	64	12.3	56	13.7	100	19.6	148	31.9
11. Place of IFA								
RUHSA	240	46.0	193	47.2	63	12.4	32	6.9
Mobile Clinic	320	61.3	169	41.3	1	0.2	0	0.0
CMC	29	5.6	0	0.0	10	2.0	6	1.3
Private Hosp	17	3.3	38	9.3	38	7.5	0	0.0
Medical Shop	22	4.2	57	13.9	19	3.7	33	7.1
VHN	91	17.4	48	11.7	315	61.8	0	0.0
Govt PHC	64	12.3	27	6.6	69	13.5	0	0.0
Don't Know	64	12.3	58	14.2	99	19.4	0	0.0
12. Side Effects of IFA								
GIT Upset	16	3.1	25	6.1	33	6.5	26	5.6
Nausea/Vomit	9	1.7	4	1.0	4	0.8	8	1.7
Black Stool	1	0.2	25	6.1	1	0.2	29	6.3
Heat/Indigest	5	1.0	0	0	3	0.6	0	0.0
Don't Know	492	94.3	365	89.2	472	92.5	416	89.7

b. PRACTICE

The ANC registration in K.V. Kuppam block ensures that women in pregnancy are registered and have undergone the medical checkup by a nurse or doctor, obtained IFA tablets, TT injections and other care like identification for high risk. However in the control block, the government VHN record them in the registers, and at the most gave them 30 IFA.

There is a slight shift towards 3rd and 4th month registration in the intervention area. Also one fourth of the women obtained more than 90 IFA tablets and the same proportion consumed also. In the control area it was only 13% in the post intervention phase.

In the intervention area only 162% and 22.3% did not register and receive IFA respectively where as in the control block it was 20.8% and 37.7%.

Half of the registration for K.V. Kuppam block was done in the mobile clinics before intervention, the shift shown in the data between mobile clinics and RUHSA is not the true picture, it was the bias introduced by some of the data collectors having considered mobile clinics and RUHSA as one and the same.

Almost 62.2% of the women who are eligible for worm infestation treatment (≥13 wks of gestational age) had taken Mebendazole tablets 600 mg. in the study area.

When the same analysis was done taking into account only those who were in the gestational age of ≥28wks (180 pregnant women)and stayed for more than or equal to 3 months of their pregnancy in the block (155 pregnant women), it was found that 91% had registered before 2nd trimester and 83.8% had registered in RUHSA hospital or in the mobile clinics run by RUHSA. In the same group, 52.3% had obtained more than 90 iron tablets and 52.3% had consumed more than 90 iron tablets. Also 74.2% and 72.3% had obtained and consumed more than 60 iron tablets and 31.6% and 28.4% had obtained and consumed more than 120 tablets. Of these women 71.6% were dewormed with mebendazole 600 mg. In the control area women were not dewormed for hookworm infestation.

Diet modification was not made by the pregnant women as expected. Most of them were not able to eat more.

GIT upset, constipation, nausea, loss of appetite and black stools were the side effects reported because of IFA consumption. In the pre intervention survey women did not state black stool as one of the side effects, but few had said it in the post survey. However GIT upset was stated by 4.8%, 8.3%, 6.3%, and 10.1% of the total women surveyed in the pre and post intervention survey in KVK and Gudiyatham blocks respectively and the difference between the pre and post is not significant. However very few had discontinued because of the said side effects.(Table 3.4)

TABLE 3.3 : PRACTICE ON IFA AND FOOD HABITS AMONG PREGNANT WOMEN - COMPARISON

PRACTICE	KV KUPPAM BLOCK				GUIDYATHAM BLOCK			
	PRE		POST		PRE		POST	
	No.	% n=522	No.	% n=409	No.	% n=510	No.	% n=464
1. MONTH OF REGN								
2 nd	4	0.8	5	1.2	5	1.0	17	3.7
3 rd	29	5.6	52	12.7	77	15.1	74	15.9
4 th	32	6.1	58	14.2	36	7.1	32	6.9
5 th	196	37.5	153	37.4	151	29.6	129	27.8
6 th	31	5.9	20	4.9	2	0.4	32	6.9
7 th	17	3.3	7	1.7	37	7.3	29	6.3
8 th	4	0.8	3	0.7	9	1.8	5	1.1
9 th	3	0.6	0	0.0	0	0.0	0	0.0
Not Registered	79	15.1	66	16.2	56	11.0	97	20.8
Not applicable	127	24.3	45	11.0	114	22.3	49	10.6
2. IFA RECEIVED								
1 - 30	109	20.9	73	17.8	83	16.3	108	23.3
31 - 60	70	13.4	53	13.0	92	18.0	58	12.5
61 - 90	65	12.5	56	13.7	55	10.8	30	6.5
91 - 120	38	7.3	37	9.0	62	12.2	29	6.3
> 121	34	6.5	63	15.4	48	9.4	31	6.7
Not received	79	15.1	91	22.3	56	11.0	175	37.7
Not applicable	127	24.3	36	8.8	114	22.3	33	7.1
3. IFA CONSUMED								
1 - 30	127	24.3	78	19.1	120	23.5	113	24.3
31 - 60	65	12.5	49	12.0	85	16.7	50	10.8
61 - 90	57	10.9	53	13.0	64	12.5	29	6.3
91 - 120	60	11.5	44	10.8	69	13.5	32	6.9
> 121	5	1.0	55	13.4	2	0.4	24	5.2
Not consumed	81	15.5	94	23.0	56	11.1	183	39.4
Not applicable	127	24.3	36	8.8	114	22.4	33	7.1
4. DIET DURING PREGNANCY								
Increased	171	32.8	126	30.8	163	32.0	100	21.6
Same	199	38.1	121	29.6	115	22.5	172	37.2
Decreased	152	29.1	162	39.6	232	45.5	191	41.2

5. AMARANTH								
Daily	27	5.2	-	-	24	4.7	-	-
Weekly twice/ once	420	80.4	322	78.7	377	73.9	322	69.4
Monthly twice/ once/never	75	14.4	87	21.3	109	21.4	142	30.6
6. CABBAGE								
Daily	2	0.4	0	0.0	1	0.2	0	0.0
Weekly twice/ once	336	64.4	217	53.1	301	59.0	139	30.0
Monthly twice/ Once/never	184	35.2	192	46.9	208	40.8	325	70.0
7. LEMON								
Daily	20	3.8	0	0.0	11	2.2	0	0.0
Weekly twice/ once	107	20.5	77	18.8	101	19.8	74	15.9
Monthly twice/ once/never	395	75.7	332	81.2	398	78.0	390	84.1
8. MEAT								
Daily	4	0.8	0	0.0	5	1.0	0	0.0
Weekly twice/ once	293	56.2	265	64.8	299	58.6	287	61.9
Monthly twice/ once/ never	225	43.0	232	56.7	206	40.4	177	38.1

TABLE 3.4 : PRACTICE OF PREGNANT WOMEN IN STUDY AND CONTROL AREA

PRACTICE	K.V.KUPPAM				GUDIYATHAM			
	No.	% n=522	No.	% N=409	No.	% n=510	No.	% N=464
1. PLACE OF REGISTRATION								
PSU(Mobile Clinic)	267	51.1	108	26.4	6	1.2	0	0.0
VHN	28	5.4	16	3.9	249	48.8	206	44.4
RUHSA Hospital	65	12.5	142	34.7	42	8.2	30	6.5
CMC & H	15	2.9	15	3.7	4	0.8	7	1.5
Government Hospital	7	1.3	5	1.2	17	3.3	43	9.3
Private	0	0.0	11	2.7	0	0.0	28	6.0
Not registered	206	39.5	112	27.4	170	33.3	150	32.3

2. NATURE OF SIDE EFFECTS	n=30		n=110		n=36		n=97	
GIT Upset	25	83.3	34	30.9	32	88.9	47	48.5
Constipation	0	0.0	0	0.0	2	5.6	0	0.0
Nausea	7	23.3	2	1.8	3	8.3	2	2.1
Loss of appetite	2	6.7	1	0.9	0	0.0	3	3.1
Black Stool	1	3.3	93	84.5	0	0.0	61	62.9
3. DISCONTINUED IFA	No.	% n=316	No.	% n=282	No.	% n=340	No.	% n=256
Yes	30	9.5	18	6.4	23	6.8	33	12.9
No	286	90.5	264	93.6	317	93.2	223	87.1
4. REASONS	No.	% n=30	No.	% n=18	No.	% n=23	No.	% n=33
Stomach Pain	13	43.3	2	11.1	16	69.6	9	27.3
Fever	6	20.0	3	16.7	2	8.7	2	6.1
Vomit	5	16.7	5	27.8	3	13.0	6	18.2
Chest Discomfort	4	13.3	0	0.0	2	8.7	1	3.0
Forgets/Didn't like	2	6.7	9	50.0	0	0.0	2	6.1
No Reason	0	0.0	0	0.0	0	0.0	3	9.1
Tab not available	0	0.0	0	0.0	0	0.0	4	12.1

Table 3.5 : PRACTICE OF IRON PROCUREMENT & CONSUMPTION AMONG WOMEN IN THE ≥ 13 WKS AND ≥ 28 WKS GESTATIONAL AGE

TABLETS	GA≥13 WKS STUDY		CONTROL		SIG LEVEL	≥28 WKS STUDY		CONTROL		SIG LEVEL
IRON PROCURRED		n=373		n=431			n=155		n=182	
≥ 60	156	41.8	90	20.9	P<0.001	115	74.2	77	42.3	P<0.001
≥ 90	100	26.8	60	13.9	P<0.001	81	52.3	55	30.2	P<0.001
≥ 120	63	16.9	37	8.6	P<0.001	49	31.6	29	15.9	P<0.001
IRON CONSUMED										
≥ 60	152	40.8	85	19.7	P<0.001	112	72.3	72	39.6	P<0.001
≥ 90	99	26.5	56	13.0	P<0.001	81	52.3	53	29.1	P<0.001
≥ 120	55	14.7	24	5.6	P<0.001	44	28.4	22	12.1	P<0.001

TABLE 3.6 : PRACTICE ON DEWORMING AMONG PREGNANT WOMEN AFTER INTERVENTION IN STUDY AND CONTROL AREAS

PRACTICE	K.V.KUPPAM				GUDIYATHAM	
	GA≥ 13 WKS		GA≥ 28 WKS		GA≥ 13 WKS	
DEWORMING	NO	% n=373	NO	% n=155	NO	% n=431
1. Mebendazole taken						
3 Days	210	56.3	111	71.6	2	0.5
1-2 Days	22	5.9	11	7.1	0	0.0
Not taken	141	37.8	33	21.3	429	99.5
2. Place of Mebendazole taken						
RUHSA	227	60.9			2	0.5
Others	5	1.3			0	0.0

4. EFFECTIVENESS OF THE PROCESS OF IEC COMPONENT

While the pregnant women were asked, the different IEC materials witnessed, 52.8% had seen the flash cards on anemia, 4.4% had seen the video on anemia, 3.2% heard the songs on anemia through audio cassettes and 5.4% had read the messages in the hand bills on anemia. They were asked to judge the effective method of communication, 44% said that flash cards used by FCV gave them the clear information about anemia.

Effectiveness of Hook worm communication was felt by 45.5% of the pregnant women. This was elicited to find out whether hook worm information got equal importance amidst the other information.

Of the different strategies used for IEC, 39.1% came to know about anemia through one to one approach by FCV using flash cards, 27.4% had it through group education in the clinic using flash cards and 4.2% while group education was conducted in the community. The women were asked to express their opinion on the effective communicator, 46.2% stated FCV as the effective communicator, 13% said RUHSA nurses, 12.9% Rural Community Officers and very few stated Health Aides (1.0%) and field workers (0.7%).

Only 2.4% stated that three persons as effective communicators, 15.6% two persons and 36.4% one person as the effective communicator.

This indicates the variations in the performance of their roles. It also reflects the frequency in which the method is used. The more number of times you reach the people with the same strategy, the better they remember it.

TABLE 4.1 : EFFECTIVENESS OF INFORMATION EDUCATION AND COMMUNICATION

IEC EFFECTIVENESS	NO.	% n= 409
1. METHODS WITNESSED		
a. Flash Card Seen	216	52.8
b. Video Seen	18	4.4
c. Audio Cassette Songs heard	13	3.2
d. Hand Bills Read	22	5.4
2. WHICH METHOD GAVE CLEAR INFORMATION		
a. FCV Flash Card	180	44.0
b. Video	7	1.7
c. Songs	4	1.0
d. Don't Know	225	55.0
3. EFFECTIVENESS OF HOOKWORM COMMUNICATION		
a. Effective	186	45.5
4. HEARD ANEMIA MESSAGE THROUGH		
a. Group Education in Clinic	112	27.4
b. Group Education in Community	17	4.2
c. One to one through FCV	160	39.1
5. EFFECTIVE COMMUNICATOR		
a. FCV	189	46.2
b. RCO	52	12.7
c. RUHSA Nurse	53	13.0
d. Health Aide	4	1.0
e. Field Workers	3	0.7
f. Government VHN	1	0.2
6. NO. OF COMMUNICATORS STATED		
a. One Communicator	149	36.4
b. Two Communicators	64	15.6
c. Three Communicators	10	2.4

PROGRAM EFFECTIVENESS COULD BE ATTRIBUTED TO

1. Qualitative data helped in understanding the perceptions of pregnant women and health care providers at all levels and intervention incorporated filled the gaps.

2. Intensive training to Health Volunteers in the community, health care providers in the government and RUHSA (NGO) functioning for effective counselling and communication.

3. Empowerment of health care volunteers in the use of communication strategies periodically.

4. Indepth knowledge given to the pregnant women and adolescent girls on facts of anemia, by developing few messages.

5. Need based curriculum for educating the community and training the health care providers.

6. Easy accessibility to health services for the procurement of IFA and deworming at free of cost.

7. Systematically deviced Monitoring through MIS and other devices.

B. ADOLESCENT GIRLS

1. PROFILE OF ADOLESCENT GIRLS

The subjects selected for the assessment of knowledge increase in anemia, hemotological status and nutritional status during July 1997 and June 1998 in both K.V. Kuppam Block and Gudiyatham Block had the following socio economic characteristics.

The socio economic status of the adoloscent girls are presented in Table 1. Only intervention provided was knowledge on the facts of anemia, anemia in pregnancy, iron supplementation and deworming for the study area. The socio economic characteristics used for comparison between the intervention and non intervention areas were caste, type of roof they live in, number of rooms they have, availability of latrine in their house, type of family, family size and ownership of land. Both the groups before and after the intervention are comparable, as there is no significant difference between the socio economic characteristics.

The girls' mean age and age at menarche is presented in Table 3. The girls' age ranges from 13 - 19 years with the mean age and SD of 15.64 years (SD 1.65), 15.7 (SD 1.76) and 16.28 (SD 1.64), 15.73 (SD 1.75) during pre and post in the study area and pre and post in the control area respectively. The mean and SD of age at menarche of the girls were 13.68 (SD 0.96), 13.49 (SD 1.10) and 13.92 (SD 1.18), 13.68 (SD 1.21) during the pre and post in the study area and pre and post in the control area.

The nutritional status of the subjects were assessed only during the baseline measurement in both the areas and is shown in Table 4. The mean and SD of their height, weight, arm circumference and Body Mass Index respectively were 151.53 cm (SD 6.8 cm), 37.44 kg (SD 5.96 Kg), 23.18 cm (SD 2.03) and 16.28 (SD 2.2) in the study area and 150.8 cm (SD 6.7) 37.4 Kg (SD 6.5), 23.0 cm (SD 2.2) and 16.41 (2.37) in the control area respectively. There is no significant difference in the nutritional status of the girls between the areas which indicates that they are comparable (Table 5). Almost 75 - 85% of the girls carry more than 6 to 50 pots of water every day. Also majority of them wash clothes and vessels daily.

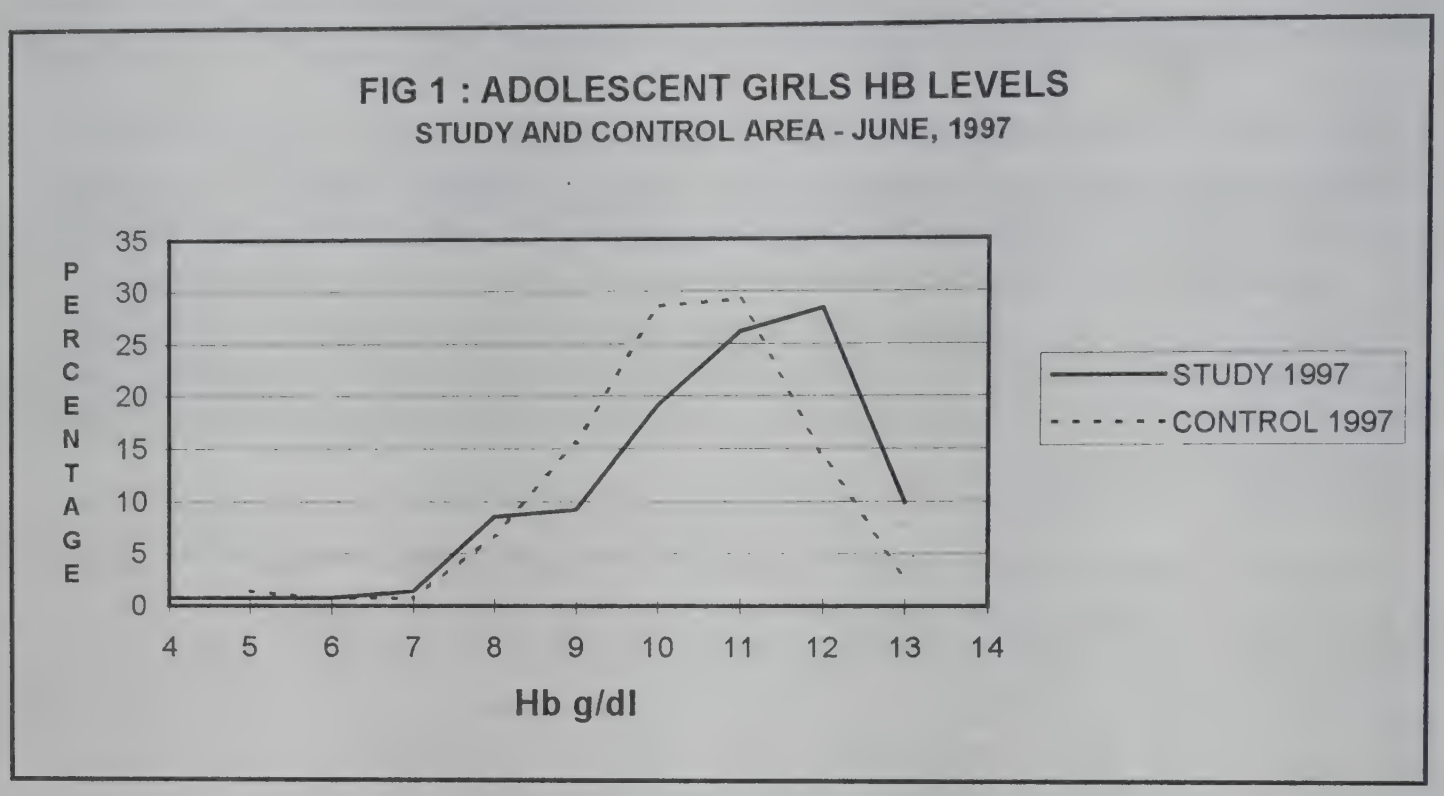
2. HEMATOLOGICAL STATUS

The hemoglobin concentration is presented in Table 6. Very few girls are severely anemic (HB <7.99 g/dl). Moderate and mild anemia is increased in both the blocks between pre and post. A significant ($P< 0.001$) increase in the prevalence of mild anemia in the study block and a non significant increase in the control block is observed.

An overall significant ($P<0.001$) increase is noted in the prevalence of anemia from 35.5% to 59.6% (24.1%) in the study block and a significant ($P< 0.001$) increase from 53.7 to 68.6% (14.9%) in the control block. This is shown in Table 7.

The mean and SD of Hb levels in the study area before and after were 12.24 g/dl (SD 1.57) and 11.32 g/dl (SD 1.46) ranging from 5 to 14.1 g/dl. In the control area it

was 11.6 g/dl (SD 1.4) and 11.14 g/dl (SD 1.59) ranging from 4 to 14.2 g/dl. The decrease in the mean hemoglobin concentration in the study area was highly significant ($P<0.001$) and the decrease in the control area was also significant ($P<0.01$). This is given in Table 8.



Hb level in g/dl	4	5	6	7	8	9	10	11	12	13
STUDY 1997	0.7	0.7	0.7	1.4	8.5	9.2	19.1	26.2	28.4	9.9
CONTROL 1997.		1.4	0.7	0.7	6.8	15.6	28.6	29.3	14.3	2.7

3. PREVALENCE OF ANEMIA IN DIFFERENT SOCIO ECONOMIC GROUPS

The prevalence of anemia in different socio economic groups in both the blocks before and after are presented in Table 9. There is no significant difference observed in the prevalence of anemia between the different socio economic groups with respect to each variable.

Even the demographic characteristics of the girls did not influence the prevalence of anemia (Table 10). It is interesting to see that the nutritional status of girls also did not have impact on the prevalence of anemia (Table 11).

Girl's education and mother's education are correlated significantly ($P<0.001$) with hemoglobin concentration. In the multiple regression analysis, girl's and mother's education were picked up as predictors for Hb.

4. KNOWLEDGE ON ANEMIA AMONG ADOLESCENT GIRLS

This increase in the knowledge of adolescent girls about the facts of adolescent anemia and anemia in pregnancy is shown in Table 12.

The knowledge on each of the signs of anemia is significantly (P< 0.001) higher except tiredness (P<0.05) in the study area, than in the control area after the intervention. Many of the signs were stated by the girls of the intervention area. Regarding knowledge related to each of the six consequences and each of the four preventions, a significant (P< 0.001) change was observed in the study area before and after the intervention compared to control area. This is presented in Table 12.

The knowledge about IFA consumption and duration to be consumed during pregnancy was significantly (P< 0.001) higher among girls of study area after intervention, compared to control area.

The knowledge about hookworm infestation, how it enters into the body through feet (P< 0.001), that it sucks blood in the body (P<0.001) and to prevent it by deworming (P< 0.001) and wearing slippers (P< 0.001) significantly increased in the study area. Almost none said that hookworm enters through skin in the study area and almost the difference was nil compared to the control area. Little more than half the girls (52.9%) were able to say hookworm enters through the feet but most of them did not know it also enters through skin. This is basically because the IEC stressed on the former fact and didn't say anything on the latter fact.

The correct age at marriage for girls was known among 59.7% of the girls in the study block and 38.1% in the control block. This difference was significant (P< 0.001). The increase in the knowledge compared to the base line was also significant (P< 0.01). It is significant to note that 59.6% did not know the correct age at marriage in the control area.

TABLE 1: ADOLESCENT GIRLS ACCORDING TO THEIR SOCIO ECONOMIC STATUS BEFORE AND AFTER INTERVENTION IN THE STUDY AND CONTROL AREAS

SOCIO ECONOMIC VARIABLES	STUDY AREA				CONTROL AREA			
	PRE		POST		PRE		POST	
	No.	% N=155	No.	% N=238	No.	% N=161	No.	% N=273
1. CASTE								
S C	46	29.7	82	34.5	61	37.9	101	37.0
B C	98	63.2	126	52.9	82	50.9	151	55.3
F C	11	7.1	30	12.6	18	11.2	21	7.7
2. ROOF								
Thatched	61	39.4	76	31.9	67	41.6	91	33.3
Tiled	50	32.2	106	44.5	51	31.7	116	42.5
Terraced	44	28.4	56	23.5	43	26.7	66	24.2

3. NO. OF ROOMS								
1 Room	51	32.9	85	35.7	51	31.7	105	38.5
2-3 Rooms	76	49.0	120	50.4	76	47.2	147	53.8
≥ 4 Rooms	28	18.1	33	13.9	34	21.1	21	7.7
4. LATRINE								
No	139	89.7	225	94.5	143	88.8	225	82.4
Yes	16	10.3	13	5.5	18	11.2	48	17.6
5. FAMILY TYPE								
Nuclear	117	75.5	180	75.6	134	83.2	188	68.9
Extended	27	17.4	30	12.6	11	6.8	31	11.3
Joint	11	7.1	28	11.8	16	9.9	54	19.8
6. FAMILY SIZE								
1 - 4	36	23.2	55	23.1	42	26.1	87	31.9
5 - 7	102	65.8	159	66.8	98	60.9	138	50.5
8 - 15	17	11.0	24	10.1	21	13.0	48	17.6
7. MOTHER'S EDUCATION								
0 - 5 Std	120	77.4	167	70.2	123	76.4	197	72.2
6 - 8 Std	22	14.2	36	15.1	27	16.8	44	16.1
≥9 Std	13	8.4	35	14.7	11	6.8	32	11.7
8. FATHER'S EDUCATION								
0 - 5 Std	93	60.0	141	59.2	106	65.8	158	57.9
6 - 8 Std	22	14.2	32	13.4	27	16.8	42	15.4
≥ 9 Std	40	25.8	65	27.4	28	17.4	73	26.7
9. LAND								
No Land	75	48.4	136	57.1	102	63.4	191	70.0
0.01 - 0.50	27	17.4	73	30.7	20	12.4	63	23.1
0.51 - 1.25	24	15.5	13	5.5	15	9.3	5	1.8
≥1.26	29	18.7	16	6.7	24	14.9	14	5.1
10. WATER FACILITY								
Open Well	19	12.3	-	-	15	9.3	-	-
Pumpset	3	1.9	-	-	5	3.1	-	-
Bore Well	46	29.7	-	-	24	14.9	-	-
Piped House/ outside	87	56.1	-	-	117	72.7	-	-

TABLE 2: ADOLESCENT GIRLS ACCORDING TO THEIR SOCIO DEMOGRAPHIC STATUS BEFORE AND AFTER INTERVENTION

VARIABLES	K.V. KUPPAM				GUDIYATHAM			
	PRE		POST		PRE		POST	
	No.	% n=155	No.	% n=238	No.	% n=161	No.	% n=273
1. AGE								
≤ 14	44	28.4	43	18.1	51	31.7	77	28.2
15 - 19	111	71.6	195	81.9	110	68.3	196	71.8
2. AGE AT MENARCHE								
Not attained Age	10	6.5	18	7.6	19	11.8	31	11.4
≥15	28	18.1	70	29.4	24	14.9	60	22.0
13 - 14	106	68.4	132	55.5	104	64.6	145	53.1
10 - 12	11	7.1	18	7.5	14	8.7	37	13.5
3. GIRLS EDUCATION								
0 - 5 Std	33	21.3	40	16.8	48	29.8	57	20.9
6 - 8 Std	66	42.6	82	34.5	57	35.4	104	38.1
≥ 9 Std	56	36.1	116	48.7	56	34.8	112	41.0
4. CARRYING WATER POTS PER DAY								
1 - 5	-	-	34	14.3	-	-	69	25.3
6 - 10	-	-	140	58.8	-	-	137	50.2
11 - 15	-	-	17	7.2	-	-	20	7.3
16 - 25	-	-	37	15.5	-	-	36	13.2
26 - 50	-	-	10	4.2	-	-	7	2.5
Not carrying water	-	-	-	-	-	-	4	1.5
5. WASHING CLOTHS/VESSELS								
Yes	-	-	233	97.9	-	-	244	89.4
No	-	-	5	2.1	-	-	29	10.6

TABLE 3: MEAN, SD, RANGE OF AGE AND AGE AT MENARCHE OF GIRLS

VARIABLES	STUDY AREA		CONTROL AREA	
	PRE	POST	PRE	POST
Age	n=155	n=238	n=161	n=273
Mean	15.64	16.28	15.70	15.73
SD	1.65	1.64	1.76	1.75
Range	13-19	13-20	13-19	13-20
Age at Menarche	n=145	n=220	n=142	n=242
Mean	13.68	13.92	13.49	13.68
SD	0.96	1.18	1.10	1.21
Range	12-17	10-17	10-18	11-17

TABLE 4: NUTRITION STATUS OF ADOLESCENT GIRLS BEFORE INTERVENTION

NUTRITIONAL STATUS	STUDY	CONTROL	COMBINED
HEIGHT	n=152	n=161	n=313
Mean	151.53	150.03	150.76
SD	6.8	6.6	6.72
Range	117.8-168.5	130.1-167.3	117.8-168.5
WEIGHT	n=152	n=161	n=313
Mean	37.44	37.35	37.40
SD	5.96	7.00	6.51
Range	22.0-59.5	22.0-73.5	22.0-73.5
ARM CIRCUMFERENCE	n=151	n=161	n=312
Mean	23.18	22.9	23.03
SD	2.03	2.36	2.2
Range	16.2-29.0	16.3-33.0	16.2-33.0
B M I	n=152	n=161	n=313
Mean	16.28	16.54	16.41
SD	2.2	2.52	2.37
Range	11.76-25.62	10.53-29.52	10.53-29.52

TABLE 5: ADOLESCENT GIRLS NUTRITIONAL STATUS BEFORE INTERVENTION

NUTRITION VARIABLES	K.V.KUPPAM		GUDIYATHAM	
	NO.	PERCENTAGE N=155	NO.	PERCENTAGE N=161
HEIGHT				
≤ 144.9	21	13.5	31	19.3
145.0 - 149.9	34	21.9	40	24.8
Above 150.0	97	62.6	90	55.9
No Information	3	1.9	-	-
WEIGHT				
≤ 37.9	89	57.4	88	54.7
38.0 - 39.9	20	12.9	23	14.3
40.0 - 44.9	25	16.1	35	21.7
Above 45.0	18	11.6	15	9.3
No Information	3	1.9	-	-
ARM CIRCUMFERENCE				
≤ 22.9	70	45.2	88	54.7
≥ 23.0	85	54.8	73	45.3
BMI				
≤ 16.00	74	47.7	71	44.1
16.01 - 17.00	29	18.7	38	23.6
17.01 - 18.50	31	20.0	24	14.9
18.51 - 20.00	11	7.1	19	11.8
20.01 - 25.00	6	3.9	7	4.3
25.00 - 30.00	1	0.7	2	1.2
No Information	3	1.9	-	-

TABLE 6: ADOLESCENT GIRLS' HB LEVELS BEFORE AND AFTER INTERVENTION IN THE STUDY AND CONTROL AREAS

Hb Level	KV KUPPAM BLOCK				GUIDYATHAM BLOCK			
	PRE		POST		PRE		POST	
	No.	% n=141	No.	% n=203	No.	% n=147	No.	% n=239
0.01 - 7.99 (Severe)	3	2.1	5	2.5	3	2.0	8	3.3
8.00 - 9.99 (Moderate)	7	5.0	20	9.9	11	7.5	33	13.8
10.00 - 11.99 (Mild)	40	28.4 *	96	47.3 *	65	44.2	123	51.5
≥ 12.00 (Normal)	91	64.5 $	82	40.4 $	68	46.3 #	75	31.4 #

*, $ - P< 0.001 # P< 0.01

TABLE 7: PREVALENCE OF ANEMIA (HB<12g/dl)AMONG ADOLESCENT GIRLS BEFORE AND AFTER INTERVENTION IN THE STUDY AND CONTROL AREAS

Hb Level	KV KUPPAM BLOCK				GUIDYATHAM BLOCK			
	PRE		POST		PRE		POST	
	No.	% n=141	No.	% n=203	No.	% n=147	No.	% n=239
≤ 11.99	50	35.5	121	59.6	79	53.7	164	68.6
≥ 12.00	91	64.5	82	40.4	68	46.3	75	31.4

TABLE 8: MEAN, SD AND RANGE OF HB OF ADOLESCENT GIRLS BEFORE AND AFTER INTERVENTION IN THE STUDY AND CONTROL AREAS

Hb Level	KV KUPPAM BLOCK		GUIDYATHAM BLOCK	
	PRE n=141	POST n=203	PRE n=147	POST n=239
	*	*	$	$
Mean	12.24	11.32	11.61	11.14
SD	1.57	1.46	1.4	1.59
Range	5.3-14.8	5-14.1	6.1-14.2	4-14.2

* - $p < 0.001$ $ - $p<0.01$

TABLE 9: ANEMIA PREVALENCE (HB<12g/dl) AMONG ADOLESCENTS IN DIFFERENT SOCIO ECONOMIC GROUPS IN JUNE 1997 AND IN JUNE 1998

SOCIO ECONOMIC VARIABLES	STUDY AREA				CONTROL AREA			
	PRE		POST		PRE		POST	
1. CASTE								
S C	15	34.1	42	57.5	26	47.3	61	70.1
B C	33	37.1	66	62.3	44	57.9	87	65.4
F C	2	25.0	13	54.2	9	56.3	16	84.2
2. ROOF								
Thatched	23	39.7	35	55.6	30	50.8	52	66.7
Tiled	10	23.3	51	58.0	23	47.9	64	61.5
Terraced	17	42.5	35	67.3	26	65.0	48	84.2
3. NO. OF ROOMS								
1 Room	16	34.8	40	57.1	21	46.7	59	63.4
2-3 Rooms	24	34.3	62	60.8	41	58.6	90	70.3
≥ 4 Rooms	10	40.0	19	61.3	17	53.1	15	83.3

4. LATRINE								
No	45	35.2	115	59.9	70	53.8	136	67.7
Yes	5	38.5	6	60.6	9	52.9	28	73.7
5. FAMILY TYPE								
Nuclear	39	36.4	95	60.9	67	54.9	119	72.1
Extended	8	34.8	16	61.5	2	20.0	17	63.0
Joint	3	27.3	10	47.6	10	66.7	28	59.6
6. FAMILY SIZE								
1 - 4	17	50.0	17	38.6	16	42.1	55	72.4
5 - 7	25	27.2	94	67.1	52	56.5	85	69.1
8 - 15	8	53.3	10	52.6	11	64.7	24	60.0
7. MOTHER'S EDUCATION								
0 - 5 Std	42	38.2	83	60.6	67	60.4	116	69.0
6 - 8 Std	5	25.0	18	56.3	8	30.8	28	66.7
> 9 Std	3	27.3	20	58.8	4	40.0	20	69.0
8. FATHER'S EDUCATION								
0 - 5 Std	35	40.2	67	59.3	54	56.3	94	68.6
6 - 8 Std	3	14.3	13	44.8	15	60.0	25	71.4
≥ 9 Std	12	36.4	41	67.2	10	38.5	45	67.2
9. LAND(acres)								
No Land	26	37.1	71	61.7	48	52.7	110	67.5
0.01 - 0.50	14	36.8	37	55.2	13	48.1	44	74.6
0.51 - 1.25	7	35.0	8	61.5	7	50.0	2	66.7
1.26 & Above	3	27.3	5	62.5	11	73.3	8	57.1
10. LOCATION								
Mountain Side	16	48.5	-	-	12	42.9	-	-
Road Side	29	30.5	-	-	50	59.5	-	-
River Side	5	38.5	-	-	17	48.6	-	-

TABLE 10: PREVALENCE OF ANEMIA (<12 g/dl) AMONG GIRLS IN DIFFERENT SOCIO AND DEMOGRAPHIC CHARACTERISTICS

	STUDY AREA				CONTROL AREA			
	PRE		POST		PRE		POST	
	No.	%	No.	%	No.	%	No.	%
1. GIRLS' AGE								
≤ 14	11	28.2	22	59.5	29	61.7	39	63.9
15 - 19	39	38.2	99	59.6	50	50.0	125	70.2
2. GIRLS' EDUCATION								
0 - 5 Std	17	54.8	19	63.3	28	65.1	32	61.5
6 - 8 Std	21	34.4	36	54.5	29	53.7	58	69.0
≥ 9 Std	12	24.5	66	61.7	22	44.0	74	71.8
3. GIRLS' OCCUPATION								
Fully Employed	17	43.6	31	64.6	22	55.0	30	55.6
Studying	15	27.3	39	62.9	23	46.9	46	73.0
At Home	18	38.3	51	54.8	34	58.6	88	72.1
4. AGE AT MENARCHE								
Not attained	3	30.0	7	50.0	8	47.1	16	61.5
10 - 12	3	33.3	8	47.1	5	38.5	17	70.8
13 - 14	34	35.1	69	60.5	50	53.2	97	72.4
≥ 15	10	40.0	37	63.8	16	69.6	34	61.8
5. WATER POTS CARRIED PER DAY								
≤ 5	-	-	16	53.3	-	-	43	70.5
6 - 10	-	-	67	58.3	-	-	82	69.5
11 - 15	-	-	12	75.0	-	-	11	61.1
16 - 25	-	-	26	61.9	-	-	28	66.7
6. WASHING CLOTHES/ VESSELS								
Yes	-	-	120	60.3	-	-	142	66.7
No	-	-	1	25.0	-	-	22	84.6

TABLE 11: PREVALENCE OF ANEMIA (HB <12 g/dl) AMONG ADOLESCENT GIRLS OF VARIOUS NUTRITIONAL STATUS GROUPS

NUTRITION STATUS	K.V.KUPPAM		GUDIYATHAM		SIGNIFICANCE LEVEL
	NO	%	NO	%	
HEIGHT(Cms)					
≤ 144.9	6	31.6	19	65.5	P< 0.05
145.0 - 149.9	14	36.7	20	55.6	NS
≥ 150.0	32	36.0	40	48.8	NS
No Information	1	33.3	-	-	
WEIGHT(Kgs)					
≤ 37.9	25	30.5	45	55.6	P< 0.01
38.0 - 39.9	8	40.0	14	66.7	P< 0.05
40.0 - 44.9	9	45.0	15	46.9	
≥ 45.0	7	43.8	5	38.5	
No Information	1	33.3	-	-	
ARM CIRCUMFERENCE					
≤ 22.9 Cms.	25	38.5	41	52.6	NS
≥ 23.0 Cms.	25	32.9	38	55.1	
BMI					
≤ 16.00	23	34.3	35	53.8	P< 0.05
16.01 - 17.00	8	28.6	16	48.5	NS
17.01 - 18.50	12	44.4	15	65.2	NS
18.51 - 20.00	3	33.3	10	55.6	NS
20.01 - 25.00	2	33.3	3	50.0	
25.01 - 30.00	1	100.0	-	-	

TABLE 12 : INCREASE IN KNOWLEDGE OF ADOLESCENT GIRLS ABOUT ANEMIA IN THE STUDY AND CONTROL AREAS

KNOWLEDGE	KV KUPPAM BLOCK				GUIDYATHAM BLOCK			
	PRE		POST		PRE		POST	
	No.	% n=155	No.	% n=238	No.	% n=161	No.	% n=273
1. Signs & Symptoms								
Eye Pallor	-		180	75.6 *	-		103	37.7
Tongue Pallor	-		127	53.4 *	-		41	15.0
Whiteness of Lips	-		57	23.9 *	-		12	4.4
Paleness of nail bed	-		102	42.8 *	-		26	9.5
Spoon shaped nails	-		66	27.7 @	-		1	0.4
Tiredness	-		125	52.5 *	-		114	41.8
Breathlessness	-		51	21.4 *	-		10	3.7
Don't Know	-		24	10.1	-		94	34.4
2. Consequences								
Low birth weight	25	16.1	143	60.1 #	1	0.6	92	33.7
Maternal Death	2	1.3	76	31.9 #	1	0.6	20	7.3
Preterm Delivery	7	4.5	37	15.5 #	1	0.6	14	5.1
Abortion	4	2.6	15	6.3 #	0	0.0	7	2.6
Still Birth	5	3.2	59	24.8	0	0.0	6	2.2
Difficult delivery	23	14.8	0	0.0	5	3.1	0	0.0
Don't Know	120	77.4	78	32.8	145	90.1	159	58.2
3. Prevention								
Iron Consumption	0	0.0	124	52.1	0	0.0	51	18.7
Increased food consumption	41	26.5	175	73.5	24	14.9	168	61.5

Iron enhanced food consumption	0	0.0	31	13.0	0	0.0	6	2.1
Avoid Iron Inhibitors	0	0.0	31	13.0	0	0.0	10	3.7
Eat Veg, Fruit	28	18.1	0	0.0	9	5.6	0	0.0
ANC checkup	35	22.6	0	0.0	4	2.5	0	0.0
Don't Know	101	65.2	57	23.9	134	83.2	96	35.2
4. No. of IFA per day								
One tab		-	131	55.0		-	66	24.2
Two tab		-	8	3.4		-	23	8.4
Three Tabs		-	11	4.6		-	15	5.5
Don't Know		-	88	37.0		-	169	61.9
5. No. of Days								
5 - 9 months		-	145	60.9		-	91	33.3
Don't Know		-	93	39.1		-	181	66.3
6. Hook worm entrance								
Through Feet	8	5.2	126	52.9	1	0.6	43	15.8
Through Skin	0	0.0	1	0.4	0	0.0	6	2.2
Through feet & skin	0	0.0	3	1.3	0	0.0	6	2.2
Don't Know	147	94.8	108	45.4	160	99.4	218	79.9
7. What it does								
Sucks blood	14	9.0	119	50.0	0	0.0	61	22.3
Don't Know	141	91.0	119	50.0	161	100.0	212	77.7
8. Prevention of Hook worm								
Deworming	17	11.0	64	26.9 $	0	0.0	43	15.8
Wear in Slippers	8	5.2	40	16.8 $	0	0.0	22	8.1
Deworming & Wear in Slippers	0	0.0	27	11.3 $	0	0.0	4	1.5
Don't Know	137	88.4	107	45.0	0	0.0	204	74.7
9. Age at Marriage								
21 Years	72	46.5	142	59.7 $	50	31.1	104	38.1
Wrong answers	75	48.3	92	38.7	92	57.1	162	59.3
Don't Know	8	5.2	4	1.7	19	11.8	7	2.6

@ - P<0.05, # - P< 0.001, $ - P< 0.01 Between Pre and Post in Study area.
* - P<0.001 Between Post Study and Control area

VIII. DISCUSSION

A. PREGNANT WOMEN

The findings of this study contribute to the increasing pool of knowledge on overcoming anemia in pregnancy. Small sample, hospital based studies have shown increase in hemoglobin levels among pregnant women. However this is one of the few studies showing a significant reduction in anemia in a community setting.

1. IMPACT OF ANEMIA CONTROL PROGRAM

Despite previous effectiveness or efficacy in small scale trials, few large - scale supplementation programs have been found to be operationally successful. (Gillespie SR 1998). The main operational constraints identified in a review of 6 large scale programs aimed at pregnant women were : Inefficient and irregular supply, procurement and distribution of supplements, low accessibility and utilisation of antenatal care by pregnant women, inadequate motivation and training of frontline health workers, inadequate counselling of mothers and low compliance by the beneficiaries with the supplemented regimen. (Gillespie et al 1991).

An evaluation of the National Nutritional Anemia Prophylaxis Programme in eleven states of the country by the Indian Council of Medical Research (ICMR) clearly showed that the program failed to make any noticeable impact on reducing incidence of anemia despite being in operation from 1970 for 15 years (GOI, 1989).

Major recommendations of the National Consultation on control of Nutritional Anemia in India held in October 1997 was a comprehensive strategy comprising of 1. Dietary diversification 2. Pharmaceutical control 3. Food fortification and 4. Hook worm and malarial control (GOI, 1998). Additionally an effective Information Education and Communication (IEC) was also considered as an integral and critical component for the control of nutritional anemia in the country.

The intervention adopted for this project broadly fits in with the guidelines provided by the International Nutritional Anemia Consultative Group (INACG) to prevent and control anemia (Stoltzfus RJ and Dreyfuss ML, 1998). These are also identified by Gillespie for the Micronutrient Initiative and UNICEF (Gillespie SR, UNICEF, 1998). These included iron supplementation, treatment of helminths and dietary modification backed by improved communications and social marketing. The interventions carried out attempted to overcome the problems identified above for the ineffectiveness of large scale programs.

Most studies on anemia in pregnancy have been based on the data collected from hospital based pregnant women. However, this study was based on a randomly selected representative sample of pregnant women both in the intervention area as well as in the control area. This study design makes the data available more representative of the community than those coming from hospital based pregnant women.

The intended outcome was 15% reduction in anemia prevalence in two years. However the achieved outcome was 24.1% with 95% confidence interval of 17.6% - 30.6%. As a result of this program the prevalence which was at a high level in the region of the seventies came down to just over 51.4% showing a decrease of nearly 27%.

One study that has serial hemoglobin levels and showing a decline is Montserrat Island in the Caribbean. Estimated anemia prevalence in 1980, 1985 and 1990 showed a decline from 82% to 23% and finally to 19% while there was no specific intervention program. Better nutrition resulting from the improved standard of living, health education and food supplementation are assumed to have contributed to the change (Simmons WK et al 1996).

One salient feature of this intervention block is that, despite the additional input given since 1977 for almost two decades focusing on mother and child care, established weekly clinics in 18 Peripheral Service Units for antenatal care, distribution of IFA, the anemia prevalence in 1991 was 76% (Koen MC 1992) and the prevalence (70.3%) remained the same as that was in the control area (68.2%) even in June 1996. The prevalence decreased to 51.4% in the study area after this intervention.

This significant reduction was possible only with easy accessibility for intensive mebendazole treatment for 1 1/2 years, early IFA distribution, proper counselling to clients, appropriate education to health care providers about facts of anemia, awareness created among general community and adolescent girls on anemia which was not considered as a major disease and contact of each pregnant woman a number of times by different health personnel in their homes or while visiting clinics. In addition a systematic monitoring of each activity also contributed significantly to this change. This change in anemia prevalence has been shown within a short period of over 18 months of intervention. However it has been observed in this area that when only iron and folic acid supplementation was given over a period of nearly 18 years there was no change observed, comparing a study of 1990 with that of the baseline of this study. Therefore it is important to analyse the additional factors that could have contributed in this study.

The three major and significant inputs that differed from our earlier inputs were increased knowledge among pregnant women on the causes, consequencesand prevention of anemia during pregnancy and consumption of mebendazole for deworming and indepth training to health care providers of RUHSA and Government staff who are functioning in this area. We are not aware of any effort on significant knowledge input as in this study. However it is well known that educational inputs do bring about health changes (Saminathan P, 1986). The effectiveness of deworming either alone or in combination with IFA in increasing hemoglobin concentration have been recently documented among school children (Stoltzfus RJ 1997, Stoltzfus RJ 1997) and among pregnant women (Atukorala TM 1994, Stoltzfus 1998).

In the control area although registration levels appear high, registration by VHN indicates only identification of the pregnant women and making a record of the pregnancy whereas in the intervention area, a thorough ANC care is provided including checking blood pressure, weight, urine albumin and dispensing IFA and mebendazole.

With the evidence that is available from this study we would conclude that intervention programs to reduce anemia in pregnancy must include IFA and deworming for hookworm as it is significant in this area. Both IFA and mebendazole appear useful combination in bringing down anemia in pregnant women.

All the constraints identified by Gillespie et al (1991) were overcome during this research which gave an effective result. Nevertheless it should be continued further to bring it down so that anemia could be considered as a problem of low magnitude.

2. PREVALENCE OF ANEMIA

The prevalence of anemia in pregnant women was found to range from 21% to 80% in different countries (WHO 1968). Of the countries studied India had the highest prevalence. When compared to the prevalence in other countries this prevalence in a rural population of Tamil Nadu, India, is similar. Brabin L et al (1998) reported a high prevalence of 79.6%for Mumbai, India. In the South East Asian Region, Bangladesh reported 77% prevalence in 1981-82 with no change in 1992. In Indonesia it was 63.5%, in Maldives 68%, in Myanmar 58%, in Nepal 50 - 65% in 1993 and 60 - 70% in Sri Lanka. Only Thailand reported a prevalence of 15% (WHO SEARO 1995). A later study in Indonesia reported a prevalence of 52.3% among pregnant women (Gross 1997).

Bergsjo P et al (1996) recorded a prevalence of 75% for Tanzania. It was 74.6% for Kenya as reported by Schulmann (et al 1996). A study from Mali placed its prevalence at 36.8% (Diallo D et al 1995). In the Caribbean Freire WB (1997) reported a level of 66%.

As a result of a WHO sponsored collaborative research study in the seventies on the effects of iron supplementation to pregnant women, the base line data recorded for Delhi was 87% and for Vellore it was 88% among those with gestational age 24 weeks and above (Sood S K et al 1975). The baseline of the present study also had 68.8% prevalence in the same gestational age group in 1996 and decreased to 56.5% after intervention. However the prevalence was increased to 80% in the control area in 1998, among those with≥ 28 weeks. Koen et al, recorded 77% prevalence among pregnant women in this block in 1992. The salient finding of the former study was that even with administration of 120 or 240 mg of iron, folate and vitamin B12, 56% of the women still had a final hemoglobin concentration below 11 g/dl. Inspite of the effort made to quantify the worm load, there was no action taken for deworming. However the present research had made a decrease from 68.8% to 56.5% during the 3rd trimester in a rural community within one and a half year's time.

3. PREVALENCE OF ANEMIA IN DIFFERENT TRIMESTERS

During the first trimester of pregnancy, iron requirements are lower owing to the cessation of menses, and iron stores may even increase[1] (Kaufer 1990). At around 16 weeks of gestation maternal blood volume and red cell mass expand so that iron requirements increase substantially[3] (Allen LH 1997).

A significant increase in the mean hemoglobin concentration from 10.51 g/dl to 11.36 g/dl (P <0.001), 10.16 g/dl to 10.75 g/dl (P <0.001) and 10.13 g/dl to 10.49 g/dl (P<0.01) is observed in the first, second and third trimesters respectively. Centres for Disease Control and Prevention (1989) had suggested different cut off values (g/dl) for anemia for pregnant women in trimester 1,2, and 3 respectively at 11.0 g/dl, 10.5 g/dl and 11.0 g/dl. This has been achieved by this block after intervention except in the 3rd trimester, inspite of the significant increase compared to the base line.

The prevalence of anemia in pregnant women in their first visit to health centres of a metropolitan area in Brazil was assessed by Guerra et al (1990). They have documented that the prevalence of anemia in the first trimester (3.6%) was significantly smaller than found in the second (20.9%) and third trimester (32.1%). In this study though the prevalence is lower in the first trimester it was more or less same in the 2nd and 3rd trimesters.

It has been well documented that hemoglobin concentration vary in each of the trimesters of pregnancy. Part of this is attributed to the hemo dilution during pregnancy. In individuals not receiving iron therapy Taylor and his colleagues identified that hemoglobin decreased upto 32 weeks gestation. This level was maintained upto delivery (Taylor et al 1982). The normal Hb concentration during the trimesters range from 11-13 g/dl in the first, 10-13 g/dl in the second and 11-14 g/dl in the third trimester (Haram K et al 1997). Our data followed the pattern described by Haram. Anemia levels were low among those in the first trimester, increased for those in the second trimester and decreased a little for those in the third trimester.

4. IRON DEFICENCY

The international recommended cut off for serum ferritin to determine iron deficiency is 12 µg/L in addition to other parameters. In particular the combination of SF and Hb is used in classifying various categories for purposes of screening. (Cook J D et al 1986). Many studies have used this and identified the proportion of population below this level. Plantation workers in Srilanka during pregnancy showed iron depletion among 33.3% (de Silva SD et al 1996). Pakistani pregnant women living in Norway had ID (SF <12 µg/L) prevalence of 68% compared to 17% among Norwegian pregnant women (Brunvand et al, 1995).

While 12 µg/L is the accepted cut off for iron deficiency different levels have been used by others (Shaw NS 1996). Goonawardene et al (1995) indicated from their study of pregnant women in Srilanka, that 57% of them had SF less than 10 µg/L a level which according to them indicates complete depletion of iron stores. Bermajo et al used 25 µg/L as the cut off for iron deficiency and showed 47.5% were iron deficient.

Further in pregnancy serum ferritin is a reliable indicator only in the first trimester. Due to the physiological dilution in the second trimester and the concurrent fall in hemoglobin it becomes less reliable after the 20th week. Even though it is influenced by hemodilution, values below 15µg/L indicates iron deficiency in all stages of pregnancy (Haram K et al 1997).

We had used serum ferritin as the indicator of iron stores with a cut off at <12 µg/L. On reviewing the study it was realized that it would have been better if we had taken on one more iron stores indicator such as transferrin saturation or free erythrocyte protoporphyrin. Then it would have been easy to diagnose and estimate iron deficiency. According to the diagnostic criteria of <12 µg/L Serum Ferritin 39.2% pregnant women had iron depletion before intervention which was reduced to 27.3% after intervention. In the control area it increased from 32.7% to 35.4%. Corresponding levels of anemia were 70.5%, 51.4% for K.V. Kuppam and 68.2% and 75.5% in Gudiyatham in the pre and post periods respectively. This suggests that iron depletion was not as low as anemia. Similar observations can be made when the mean values of serum ferritin are also considered. There is increase in K.V. Kuppam and decrease in Gudiyatham. One other indicator would have helped us to determine with certainty iron deficiency (Cook JD, 1986).

This classification was found useful in identifying the different categories of iron deficiency and anemia. While significant ($P<0.01$) differences are observed in iron deficiency anemia (HB<11 g/dl & SF <12 µg/L) in the study area, the prevalence is considered low. This raises the question whether the cut off of SF of <12 µg/L is low. If a higher SF cut off is used, then the prevalence of iron deficiency anemia would be higher.

However using hemoglobin and serum ferritin, alone there is significant reduction of iron deficiency anemia in K.V. Kuppam block. Cook and Skikne had categorised iron deficiency and anemia based on Serum ferritin and hemoglobin concentration.

The prevalence of Iron Deficiency (<12 µg/L) observed in this study was 39.2% which was similar to the prevalence observed as 37% among Malaysian and Filippino pregnant women (Diallo, 1995; Kuizon, 1989)

Fenton V et al (1997) recorded that in untreated women the fall in the SF concentration occurred during the first 32 wks of pregnancy. There after SF remained at about 13 µg/L.

FACTORS

In the study area before intervention hemoglobin concentration correlated well with gravida, parity, number of living children, arm circumference and income. However in the control area none of the factors correlated with Hb.

Malfous et al (1994) recorded that the prevalence of anemia was high among those who had 7 or more deliveries. Another study by Ogbeide, et al (1994) also reported higher prevalence among para five mothers. This present study also had a high prevalence in the control area before intervention and in both areas after intervention for those women who had more than 3 deliveries. Also mean Hb was significantly higher among those who were in the nullipara than those who were above. Parity was negatively correlated with Hb in the study area and the pooled data of both the areas before intervention.

Socio economic status was correlating with Hb only in the intervention area before intervention. Similar findings were reported by Edet (1990) among Jewish Community, Guerra, et al (1990) in Brazil with higher prevalence among lower monthly income group. The mean haemoglobin concentration was high ($P<0.05$) among the women those who had 3 rooms and more than those who had just one and two. Among women who had more than 9th std education, mean Hb was significantly ($P<0.05$) higher than those who had no education in the study area before intervention. Income was also correlated in the study area before intervention. Women's education was highly correlated with Hb in the study, control and pooled data after intervention. Women's education and latrine were picked up as predictors in the study area after intervention. Women's education, number of rooms they have and family size were picked up as predictors in the control area after intervention in the multivariate analysis. These findings indicate that socio economic factors also contribute to etiology of anemia depending on the environment and may vary from place to place.

For purposes of better correlation the baseline data was pooled together for some of the analysis as the data was similar. The same factors namely gravida, parity, number of living children and arm circumference except income correlated with Hb at high significance levels. Serum ferritin correlated well with height. When the data was pooled together the correlation remained significant.

In the post intervention survey women's education and gestational age were also picked up though gravida and parity were not picked up for hemoglobin. Hemoglobin is highly significantly correlated with serum ferritin which indicates that iron deficiency is the cause of anemia.

Even with a limited cross sectional study the investigators in their desire to identify the maximum factors that cause anemia attempted to infer information that could only be provided by a case control study or a community trial or a clinical trial. Only these studies can clearly indicate the suitability of an indicator.

METHODOLOGICAL ISSUES

Certain methodological issues stand out in this study. This was the first time a qualitative research was introduced into a health research in RUHSA. However we introduced this after having completed the quantitative baseline survey. If the qualitative survey had preceded the quantitative survey then the baseline knowledge, attitude and practices could have been different. Now we recommend that whenever possible a qualitative research should precede a quantitative research. Both reinforce one another and the outcome is much better than when a qualitative survey follows a quantitative survey. This helped in planning more effective interventions.

Our study was on pregnant women. Therefore we took pregnant women of all trimesters. The impact of our intervention could be best studied among pregnant women in the third trimester. They would have completed all the interventions and the impact can be best measured in this group. Unless there is a specific purpose of studying in different trimesters, studies intending to measure the impact of an intervention would find it more useful to select women in their third trimester.

A research of this nature requires a multi disciplinary team of professionals involving Doctors, Nurses, Researchers, Statistician, Nutritionist, Health Educators, Lab Technicians and Health Volunteers. These workers should be uniformly educated on the various aspects of the research and intervention so as to obtain uniform information.

Community based research involving drawing of blood could be carried out smoothly when experienced laboratory technicians are available who could draw blood causing minimum pain. It is quite unlikely that we would have obtained such a response with an inexperienced laboratory technician.

One of the biggest and most successful inputs in this study was what is broadly termed as IEC. However what was provided was much more than what most IEC programs provide. Ours was based on a curricular approach focusing on learning rather than just teaching. We expected specific behaviour change and the knowledge provided was to ensure such change. The comprehensive educational inputs to health care providers at all levels of health functionaries in this area and client groups included pregnant women and adolescents girls. To back our education program services were available at the community level which were easily accessible and affordable.

We had hoped to link up the success of an intervention program among adoloscent girls as also another successful strategy. However our post evaluation indicated that the protocol for adoloscent girls was not rigidly followed resulting in no improvement in anemia among adoloscent girls.

Some data on nutrition tends to support the improved nutritional status of pregnant women. Mean height, stunting, underweight and Body Mass Index (<18.5) were statistically significant and better among pregnant women in K.V. Kuppam block than in Gudiyatham block during base line survey. It was these women who as adoloscents would have received inputs prior to their marriage. However then it is difficult to explain why hemoglobin among pregnant women in K.V. Kuppam was low at baseline except by saying that pregnancy itself reduces hemoglobin levels and that the nutrition inputs were not adequate to decrease prevalence of anemia (Taylor DJ et al 1982).

KNOWLEDGE

A report on controlling iron deficiency which was based on evaluation information from six operational programs (Burma, the Caribbean, India, Indonesia, Thailand, Zimbabwe) stated lack of awareness among pregnant women on anemia as a constraint for the anemia control program (ACC/SCN, 1991). Even where education intervention is carried out it failed to bring the desired behavioural changes as it did not analyse the community's beliefs, knowledge, attitude and practices on anemia prior to intervention. Identifying pregnant women's perceptions on anemia prior to intervention is crucial as it will provide guidelines for IEC intervention. As of date there is only one study available on the knowledge, attitude and practice of mothers on anemia. This study was hospital based and it covered only limited aspects on anemia. It focussed only on cause and treatment. According to this study 85% of the pregnant women were aware of the causes and prevention of anemia (Massawe, 1995). The evaluation of National

Nutritional Anemia Prophylaxis Program in India measured knowledge on anemia among pregnant women and refers to only signs and symptoms of anemia (Ministry of Health and Family Welfare, 1989). The present research had made a significant change in the knowledge and practice of anemia. The knowledge input was intensive and extensive to be retained by the clients. The process was efficient with effective monitoring. Some of the women were able to say all symptoms, causes, consequences and prevention of anemia. Moreover this would be the first research focusing on KAP in a rural community setting.

CONCLUSION

A recent workshop (WHO - SEARO 1995) used the following cut off suggested by WHO to determine if IDA was a major problem in any country. Prevalence less than 5% was considered as not a problem, 5 - 14% as low magnitude, 15 - 39% as moderate magnitude and prevalence above 40% as high magnitude. According to this classification in India and in our project area, anemia is a major problem of high magnitude. This indicates a need for continuing interventions in this block to bring down the anemia levels further from high magnitude to moderate and subsequently to low magnitude.

B. ADOLESCENT GIRLS

Despite the effort taken to have a comparable group between the blocks, it was observed a lower prevalence of hemoglobin concentration among girls in the K.V.Kuppam block and a higher prevalence in the Gudiyatham block.

Adolescence is a significant period of human growth and maturation, unique changes occur and many adult patterns are established. During the adolescent growth spurt, the risk of anemia reappears for both boys and girls (Dallman etal 1980), after which it subsides for boys but remains for girls because of menstrual blood loss. Iron deficiency affects the ability of adolescents to learn too. The USAID / OMNI / PCD consultation concluded (Draper 1997) that "iron supplementation resulted in significant improvement in school measurements of verbal and other measurable skill among primary school children and adolescents". In a multicountry study on nutritional status of adolescents carried out by the International Centre for Research on Woman, anemia was found to be the most widespread nutritional problem and prevalences ranged from 32-55% (Kurtz and Johnson - Welch 1994). There was no gender bias in three of four studies, in which it could be assessed, whereas in the fourth more boys than girls were anemic. Based on the few data available at that time on anemia during adolescence, De Maeyer and Adiels - Tegman (1985) had earlier estimated the mean prevalence in developing countries at 27% with no gender differences.

The iron requirements of adolescent girls is very difficult if not impossible to satisfy even with good quality iron fortified diets (Viteri FE 1994). Agarwal KN (1998), had documented in his study the prevalence of anemia at 46.6% in premenarcheal girls as compared to 48.4% in post menarcheal girls in the age 10-18yrs among the urban slums of North East Delhi. Vasanthi et al(1994) observed a prevalence of (Hb <12 g/dl) 27% and 22% in the rural and urban premenarcheal girls and 24.2% and 27.8% in post

menarcheal girls in the age 11-16 years of rural and urban areas respectively, in Hyderabad. In the present study this was 40.7% and 45.2% respectively.

Mehta (1998) found out an anemia prevalence (Hb<12 g/dl) of 63.8% in urban slums of Bombay among 10-18 years adolescent girls. Seshadri (1998) recorded anemia prevalence in the same age group of girls in Bharuch district of Gujarat as 65%, 57%, and 61% in villages covered by 3 Government PHCs respectively. Agarwal (1998) documented in the urban slums of North East Delhi an anemia prevalence among adolescent girls of age group 10-19 years, as 47.6%. All the above three studies part of a multicentric study sponsored by UNICEF (GOI, 1998) had its baseline data in the 1996-97. In the study sponsored by Mother Care project, USAID, Raina et al (1996) documented a prevalence of 85.3% (Hb<11 g/dl) in rural Haryana. In this present study the baseline prevalence in K.V. Kuppam block was 35.5 %, in Gudiyatham Block it was 53.7% with a overall prevalence of 44.8%. All the first four studies were carried out in Northern India and the present study compensates for the Southern part of India and so can project a total picture for India. Jude et al had recorded a prevalence of 73.5% among the same age group of adolescent girls in K.V Kuppam block in 1991. Jude's study had very small sample of 47 girls. However the reduction over the years could be attributed to the adolescent girls program input with the knowledge on physiological growth, the consequences of early marriage, the benefits of nutrious food including green leafy vegetables and antenatal care over a period of time.

Raina et al (1996) documented severe anemia (<8 g/dl) as 37% in rural Haryana. Mehta found 4.8% severe anemia, 22.4% moderate and 36.6% mild anemia among adolescent girls of the same age group in the urban slums of Bombay. In the present study the prevalence of mild anemia (36.5%) is same as that of Bombay urban slum girls (36.6%). Severe anemia was only 2.1% .

Agha etal (1992) investigated 270 adolescents and found 18% girls had hemoglobin concentration (≤12 g/dl) and 54% girls were iron depleted. Nelson etal (1993) documented a 10.5% anemia prevalence (Hb < 12 g/dl), 4% iron deficiency prevalence (SF < 12 µg/L) and 16% with SF between 12 to 20 µg/L among white adolescent girls in the age 12 - 14 years in a south west London suburb. Rowland etal (1991) observed 46.7%, 40% and 26.7% iron deficiency anemia (SF < 12 µg/L) among swimmers, runners and non-athletes but the differences were not statistically significant. Nelson (1994) found that 20% girls had Hb <12 g/dl among 11 - 14 years (111 girls) in Wembley. Further 24% of manual social class background and 10% of non manual social class background had low Hb < 12 g/dl.

Kapoor et al (1992) recorded that 47% of high socio economic groups and 56% of lower middle class adolescent girls in the age group of 11-18 years (n=144) were anemic. In rural Rajasthan Swapna Chaturvedi et al (1996) recorded a 73.7% prevalence of anemia among 941, 10-18 years randomly selected adolescent girls. Leshan et al (1995) documented a 50% prevalence of anemia (Hb <12 g/dl) among African - American urban adolescents).

In K.V.Kuppam block, the study area, Jude et al had documented a prevalence of 73.5% among the same age group of 47 school going adolescents in 1991, with a mean

Hb level of 10.9 g/dl. In the present study, the prevalence was 35.5% and 53.7% in June 1997 in K.V.Kuppam and Gudiyatham blocks and 53.7% and 68.6% in August 1998 respectively. The reduction in the prevalence from 1991 to 1997 in K.V. Kuppam block could be attributed to the adolescent programs carried out throughout the block since 1991, reaching the girls in groups in the community and in schools with a systematic need based curriculum to increase their knowledge about their physiological growth, consequences of early marriage, importance of balanced diet, antenatal care and communicable diseases. This raises the question, whether knowledge input can change the hematological status for which the investigators do not have evidence, with authentic data.

Leshan et al (1995) had recorded mean Hb of 11.5 g/dl (SD 1.5) among African urban adolescents. In this study the same was found as 12.24 g/dl and 11.61 g/dl in 1997 in K.V. Kuppam and Gudiyatham block and 11.32 g/dl and 11.14 g/dl in 1998 respectively.

When the assessment after one year revealed an increase in the prevalence in both the blocks, it leaves the implementors with a big question. The authors are not in a position to explain the reason for the sudden increase over a period of one year from August 1997 to June 1998. Diallo 1997, found out a two fold increase in anemia prevalence in school children of Mali, from 30% in March to 58% in October. This indicates seasonality is an important issue with respect to anemia prevalence. This may not be considered for the present assessment, as both the prevalences were done in the same month.

The intended program to prevent and control anemia for adolescent girls with IFA supplementation and deworming was not carried out due to lack of time. Only intensive knowledge input was provided through out the block.

Very seldom adolescents' knowledge on anemia is researched. Of the three studies sponsored by UNICEF as part of multicentric studies among urban slums of Bombay, village girls of Bharuch district in Gujarat and urban slum girls of North East Delhi, Sheshadri had elicited the knowledge of the girls on anemia. Among the village girls of Bharuch district 36% stated tiredness, 40% pallor as symptoms after intervention. In our study 52% and 75.6% stated tiredness and pallor respectively and also many other symptoms were stated. As prevention of anemia, 48% Bharuch district girls stated Iron tablets, whereas 51.1% of our girls stated Iron tablets, increased diet was stated by 73%, consuming iron enhancers (13%) and avoiding iron inhibitors (13%) were also stated.

Our experience on IEC is unique which brings about a significant change in the client's knowledge. While communicating specific messages, whether the client can repeat the information should be assessed and confirmed and this is very important. The increase in the knowledge on anemia among adolescents was excellent in the block. However, it should be reinforced again and again for the retention of knowledge and also to have a significant spread effect.

IX. LIMITATIONS

The subjects chosen for post evaluation was randomly done as it was in the pre evaluation. All pregnant women were in the process of procuring and consuming IFA. This group is not appropriate to make an assessment on the total number of IFA obtained and consumed and the month of ANC registration. Instead all those who were in the 9th month of their pregnancy in the entire block would have constituted an ideal sample . This would have given the real picture of the time of ANC registration and the IFA procurement and consumption pattern.

As more concentration was given to pregnant mothers, adolescent girls were not adequately intervened with IFA and deworming as planned, though IEC was effectively carried out.

As low priced iron and folic acid tablets available earlier in the market were withdrawn due to low profitability, only ferrous sulphate tablets with 60 mg of elemental iron was provided in place of iron with folic acid.

X. RECOMMENDATIONS

The effectiveness of IEC component alone in the reduction of Iron deficiency anemia needs to be studied using a different research design having equal service component in both study and control areas.

It is necessary to carry out further studies on the use of anthelminthics in pregnancy, community based randomised intervention trials may be carried out to determine the amount of change in Hb levels attributable to deworming.

With the use of anthelminthics being routinely recommended our study shows the need for including in medical and nursing curricula the role of anthelminthics in anemia during pregnancy.

In follow up studies it would be more effective to select a sample of women in the third trimester who would have enough time to practice the changes in behaviour taught through IEC.

There is a need to clearly identify the ideal set of indicators with appropriate cut off needed to identify iron deficiency anemia. The confounding caused by infection on serum ferritin makes it necessary to consider serum transferrin receptor and erythrocyte protopophyrin.

XI. LESSONS LEARNED

1. When qualitative research precedes quantitative research on a particular aspect, it improves the quality of the quantitative research and facilitates more effective and appropriate intervention.

2. Qualitative research by itself gives a valuable information regarding any issue which has not been properly understood by the community.

3. IEC is effective for the behavioural changes among the target group if the provision of services are available, affordable and accessible.

4. Effective intervention makes changes in the behaviour of the pòpulation (GO & NGO).

5. Accurate knowledge on any issue to be handled is very much needed uniformly among the health care providers for effective intervention.

6. A team of multidisciplinary professionals ensures an effective output (Doctors, Nurses, Researcher, Statistician, Health Educator, Lab. Technician, Volunteers etc).

7. Success of a program which deals with a procedure such as drawing blood from the general population depends on the efficiency of the laboratory technician. (pain free drawing of blood)

8. IEC Programs which are carried out using a curriculum approach is more effective than when using a program approach.

9. Clinical signs and symptoms cannot be used for screening anemia as the sensitivity and specificity were found to be below.

10. It is necessary to educate women on the purpose of giving any medicine such as mebendazole or IFA and identify with the tablet given. Only repeated information makes them relate the tablet with the purpose.

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APPENDIX A

A PROGRAM TO PREVENT AND CONTROL ANEMIA AMONG PREGNANT WOMEN

PREGNANT WOMEN SCHEDULE - POST EVALUATION SURVEY - JULY 1998

Block No.	Panchayat No.	Subject No.

a) Subject Name :_____

b) Husband's Name :_____

c) Street No :_____

d) Village Name :_____

A. SOCIO-DEMOGRAPHIC INFORMATION

1. Religion : 1. Hindu 2. Christian 3. Muslim 4. Others
2. Caste :_____ 1. SC 2. BC 3. FC
3. Type of roof : 1.Thatched 2. Tiled 3. Terraced
4. Availability of latrine : 1. No 2. Kutcha 3.Pucca
5. No. of rooms (Excluding Kitchen) :_____
6. Land Holding (own): a) Wet _____acres b) Dry _____acres
7. Type of Family : 1. Nuclear 2. Extended 3. Joint
8. Size of the Family: _____
9. Age (Completed):_____ 10. Education(Completed):_____
11. Occupation : _____
12. Husband's Education : _____
13. Husband's Occupation : _____

RISK FACTORS OF ANEMIA

14. Age at menarche:_____ 2. Age at marriage:_____
15. Age at First Pregnancy :_____
16. a) LMP _____ b) GA (WKS) _____

17. Pregnancy No.	: 1	2	3	4	5	6	7
a) Preg. Outcome AB/SB/LB	:						
b) Current Status Living / Died	:						

G	P	AB	SB	D	LIV

18. Spacing between current and previous pregnancy : _____months

C. MEASUREMENTS

19. Hb Estimation: _____ g/dl 20. SF Estimation: _____ µg/L
21. Presence of hook worm ova : 1. Yes 2. No

D. KAP SURVEY

I. KNOWLEDGE OF MOTHERS ON ANEMIA AND IFA SUPP. PRG.

22. What are the words you say for lack of blood in the body Local term.
    1. Iratham Illai 2. Iratham Sundipochi 3.Vellai Kaamalai
    4. Varatu Kaamalai 5. Kaamalai 6. Iratha Sohai 7. Oothu Kaamalai
    8. Kaikal Veluppu/Udambu Veluppu 9. Manjal kaamalai 99. DK

23. Are you aware of Iratha Sohai (Anemia) ? What is It?
    9. DK
24. Who informed: 1.RUHSA 2.GOVT 3. Others_____ 8. NA
25. What are the signs and symptoms of lack of blood or Iratha Sohai (Anemia) during pregnancy?
    1. Whiteness in Tongue
    2. Whiteness inside the eye lid
    3. Whiteness in Lips
    4. Whiteness in Nail bed
    5. Spoon shaped Nail
    6. Tiredness
    7. Breathlessness
    9.DK
26. What are the causes of Lack of Blood or Iratha Sohai(Anemia)?
    1. Low intake of foods/iron rich foods
    2. Hookworm infestation
    3. Early marriage & early conception
    4. Frequent and less spaced pregnancies
    5. Others _____ 9. D.K.
27. What are the consequences due to lack of blood or Iratha Sohai (anemia) during pregnancy for the women and the baby?
    1. LBW 2. Maternal deaths 3. Pre term delivery
    4. Abortions 5. Still birth 9. DK
28. How can we detect that a pregnant women is having reduced/lack of blood or iratha sohai (anemia)?
    1. Clinical signs 2. Blood test 9. DK
29. How can anemia during pregnancy be prevented?
    1. Consumption of IFA tablets 2. Increased food consumption
    3. Consumption of food that enhances iron absorption
    4. Avoiding foods that prevents iron absorption
    5. Prevention of HW infestation/Deworming 9. DK
30. Are you aware of iron tablets given during pregnancy to prevent Iratha Sohai (anemia)?
    1. Yes 2. No
31. Where can we get iron and folic acid tablets (IFA) :
    1. RUHSA 2. RUHSA Mobile clinic/PSU 3. Private hospital 4. Medical Shops
    5. VHN/Govt. Subcentre 6. Govt PHC 9. DK

32. How many IFA tablets should a pregnant mother consume
a) For a day b) the period of consumption c) Minimum how many?
a) Tablets per day 1. One 2. Two 3. Three 9. DK
b) Period : From _____ mth Till _____ mth 9. DK
(5 Months)
c) _____ Tabs 9. DK

33. What are the side effects due to the consumption of iron and folic acid tablets?
1. GIT upset (Stomach irritation) 2. Nausea (Vomiting)
3. Black stools 4. Others _____ 9. DK

34. List foods that enhances and prevents iron absorption
a) Enhancers: 1. Amaranth 2. Lemon & Orange 3. Cabbage
4. Fresh gauva 5. Tomato (Raw) 9. DK
b) Prevents Absorption: 1. Tea 2. Coffee 9. DK

35. How does hookworm enter into the body?
1. Through the feet 2. Through the skin 9. DK

36. What does hookworm do when it gets into the body?
1. sucks blood 9. DK

37. How can hookworm infestation be prevented?
1. Deworming 2. Wearing slippers 9. DK

38. Do you walk on the stagnant pools of water in your village?
1. Yes 2. No

II. ATTITUDE (Say whether you agree or disagree)

39. Do you believe that consuming IFA tablets makes you feel healthy during pregnancy?
1. AG 2. DAG 3. DK

40. Do you think that consuming IFA will result in the delivery of healthy baby?
1. AG 2. DAG 3. DK

41. Do you agree that anemia during pregnancy should be prevented?
1. AG 2. DAG 3. DK

42. All pregnant women should consume IFA tablets?
1. AG 2. DAG 3. DK

43. There is No need to take Increased DIET during pregnancy.
1. AG 2. DAG 3. DK

III. PRACTICES

44. Did you wear slippers whenever you go out after anemia program?
1. Always 2. Sometimes 3. No

45. Did you consume deworming tablets? _____ Tabs. _____Days 9. NO
a) Where?_____ 8. NA b) Which month of pregnancy? _____ 8. NA

a) FOOD HABITS DURING PREGNANCY (Diet taboos)

46. How is your diet during pregnancy
1. Same 2. Increased 3. Decreased
Reasons:_____

47. Did you consciously reduce food to have small baby?
1.Yes 2. No

48. Did any one apart from your family members explain you on the diet during pregnancy. If yes, Name of the person
    1. FCV 2. VHN 3. HA 4. Others _____ 9. No one
49. How often did you consume the following foods during last month. (Tick)

	Meat	Siru keerai	keerai (any)	Cabbage	Lemon
1. Weekly once					
2. Weekly twice					
3. Monthly twice					
4. Monthly once					
5. Never					

50. Have you taken tea / coffee after the meals during pregnancy?
    1. Not consuming 2. Occasionally 3. Regularly

b) UTILISATION OF IRON & FOLIC ACID SUPPLEMENTATION PROGRAM

51. a) Month of ANC registration _____ 9. Not registered
    b) Place : 1. PSU 2. VHN 3. RUHSA 4. CMCH
    5. PHC 6. Govt. Hosp 7. Others 8. NA
52. Did you receive IFA tablets? 1. Yes 2. No 8. NA
53. If no, state reasons : _____ 8. NA
54. If yes, state

Place/person issued	Month of preg at time issue	Number issued	Number consumed
1.			
2.			
3.			
4.			

55. How many tablets did you consume per day?
    1. One 2. Two 8. NA
56. Can you show how many tablets are left over? Observe for
    1. No. of tablets remaining: _____ 8. NA
57. Did you discontinue the consumption of IFA Tablets?
    1. Yes 2. No 3. Reason :_____ 8. NA
58. Did you have any side effects after consuming the tablets?
    1. GIT upset (Stomach irritation)
    2. Nausea
    3. Black stools
    4. Constipation
    5. Loss of apetite
    6. No side effects 8. NA 9. DK
59. Were you advised about the side effects by Doctor, Nurse or Govt worker when they gave the tablets?
    a) 1. Yes 2. No b) Who Advised:_____ 8. NA

PROCESS (Only for K.V.K Block)

60. Did you see / hear the following:

1. Flash Cards on anemia	-	1. Yes	2. No
2. Video on anemia	-	1. Yes	2. No
3. Songs on anemia	-	1. Yes	2. No
4. Printed Bills on anemia	-	1. Yes	2. No

61. Which of the above gave you the clear information on anemia?

62. Was the communication of Hook Worm effective?

63. Where did you come to know about anemia?
    1. Group Education in the clinic.
    2. Group Education in the community.
    3. One to one at home by FCV.

64. Who was the most effective communicator?
    1. FCV 2. RCO 3. H.A. 4. Field Workers 5. RUHSA Nurse
    6. Govt VHN 7. Others (Specify)_____

Name of the Investigator	Date of Visit	Edited by	Cross Checked by

APPENDIX - B

A PROGRAM TO PREVENT AND CONTROL ANEMIA AMONG PREGNANT WOMEN
ADOLESCENT GIRLS-BASELINE SURVEY SCHEDULE - JULY, 1997

A. SOCIO-DEMOGRAPHIC INFORMATION

STUDY BLOCK

Block No.		Panchayat No.		Subject No.		FINO								

Subject Name : ----------
Father's Name :----------
Address - Street No. :----------
Village Name
1. Religion : 1. Hindu 2. Christian 3. Muslim 4. Others
2. Caste : _____
3. Type of roof : 1. Thatched 2. Tiled 3. Terraced
4. Availability of Latrine : 1. Yes 2. No
5. No. of rooms :
6. Place of drawing water : 1. Piped water at home 2. Piped water from outside
3. Bore well 4. Open well 5. Others (Specify)
7. Land Holding (own) :
a. Wet (Acres)_____ b. Dry (Acres)_____
8. Type of Family : 1. Joint 2. Nuclear 3. Extended
9. Size of the Family :
10. Geographical Location :
1. Road side 2. River side 3. Mountain side 4. Others
11. Age(Completed years) :
12. Educational Qualification(Completed) : _____
13. What is your occupation?
1. Full time employed _____ 4. At home _____
2. Studying & working _____ 5. Others _____
3. Studying _____
14. Mothers education(Completed) :_____
15. Father's Education (Completed) :_____
16. Mothers occupation : _____
17. Father's Occupation : _____

B. MEASUREMENTS

1. Hemoglobin _____ g/dl
2. Ova count _____ per/gm feaces
3. Height _____ cm
4. Weight _____ kgs
5. Arm circumference _____ cm

6. Clinical signs & symptoms (observation)

1. Whiteness in the inside of the eyelid	1. Yes	2. No
2. Tiredness	1. Yes	2. No
3. Oedema	1. Yes	2. No
4. Breathlessness	1. Yes	2. No
5. Loss of appetite	1. Yes	2. No

7. Age at menarche : _____

C. KNOWLEDGE

1. Have you heard of Iratha Sohai (Anemia)? 1.Yes 2.No
2. If yes, what it is? Is there any relation with blood?
   1. Lack of blood 3. Others
   2. Pale blood 9. DK
3. What are the words you say for lack of blood and whiteness on body (local term)
   1. Vellai kamalai 5. Kamalai
   2. Oodhu kamalai 6. Manja Kamalai
   3. Varatu kamalai 9. DK
   4. Others
4. What are the causes of lack of blood among adolescent girls?
   1. Not eating Vegetables
   2. Not Breast fed properly during childhood
   3. Not eating properly
   4. Sickness 5. Others 9. DK
5. Can you state who are all affected by the problem of reduced or weakened or pale blood?
   1. Pregnant women 5. Women in child bearing age
   2. Pre-school children 6. FP acceptor
   3. Adolescent girls 7. Others
   4. Lactating women 8. DK
6. How will you identify by looking at a adolescent girl whether she has reduced/pale/weakened blood?
   1. Pallor in cheeks 6. Tiredness
   2. Whiteness inside the eye lid 7. Breathlessness
   3. loss of appetite 8. Pallor in Tongue
   4. Oedema 9. Others
   5. Picca 99. DK
7. What happens (consequences) to a girl if the blood is reduced or weakened or becomes pale (anemia)?
   1. Tiredness 6. Affects growth (Height)
   2. Cannot work 7. Affects Weight
   3. Giddiness 8. Absent mindedness
   4. Cannot study 9. Head ache
   5. Become sick often 10. Others 99.Dk
8. How can we detect that a girl is having reduced/pale/weakened blood?
   1. Clinical signs 2. Blood test 9. DK
9. Do you think that reduced blood will affect growth?
   1. Yes 2. No 9. DK

10. What should you do to increase or make the blood red (to prevent anemia)?
    1. Eat green leafy vegetables
    2. Eat more of meat foods
    3. Consume iron tablets
    4. Take Tonic
    5. Report to a Doctor
    6. Fruits
    7. Others
    9. DK
11. Can you tell what are the foods that will increase or make your blood red?
    9. DK
12. What are the advantages a girl could have by consuming Irumbu sathu mathirai (iron & folic acid tablets)
    1. Prevents Anemia
    2. Promotes growth
    3. Prevents anemia during pregnancy
    4. Prevents Head ache
    5. Prevents giddiness
    6. Can work
    7. Can be healthy
    8. Others (Specify)
    9. DK
13. What are the consequences of reduced/pale/weakened blood to a pregnant women?
    1. LBW
    2. Frequent illness
    3. Maternal deaths
    4. Pre term delivery
    5. Abortions
    6. Still birth
    7. Others (Specify)
    8. Difficult during delivery
    9. DK
14. What all should be followed in order to prevent the problems of reduced/pale/ weakened blood during pregnancy?
    1. Consumption of Iron and folic acid tablets
    2. Increased food consumption
    3. Consumption of food that enhances iron absorption
    4. Avoiding food that prevents iron absorption
    5. Deworming
    6. To eat vegetables and fruits during pregnancy
    7. ANC Checkup
    8. Should consume tablets given by Doctor
    9. Others 99. DK
15. Are you aware of Irumbu Sathu Mathirai (iron & folic acid tablets) given to a pregnant women? 1. Yes 2. No
16. If yes can you tell how many tablets per day _____ and how long _____ months / day?
17. What are the consequences of early marriage and early pregnancy?
    1. Abortion
    2. Prematurity
    3. Delivery of LBW baby
    4. Difficult delivery
    5. Weakness to Mother
    6. Disease to Mother
    7. Others
    9. DK
18. Have you heard of hookworm infestation? 1.Yes 2.No
19. How does hookworm enter into the body?
    1. Through foot 2. Through skin 9. DK
20. What does hookworm do when it enters the body?
    1. Sucks the blood 9.DK
21. What happens to the person with hookworm infestation?
    1. Anemia 2. Causes chronic blood loss 9. DK

22. How can hookworm infection be prevented?
    1. Deworming
    2. By wearing slippers
    3. By preventing stagnation of water
    4. Washing feet 9. DK
23. Do girls do more work at home than boys?
    1. Yes 2. No
24. If yes do you think it is affecting your health?
    1. Yes 2. No
25. At what age should a girl get married? _____ age.
26. Did you have the following complaints any time in the past? Say yes or no.
    1. Not able to work Yes / No
    2. Not able to concentrate on studies Yes / No
    3. Having frequent headache Yes / No
    4. Falling sick often Yes / No
    5. Feeling tired/weak Yes / No
27. Can you tell me how many times you ate the following in the last 2 weeks?
    a) Greens b)Meat
28. Did a Doctor tell you that you had reduced blood when you went for any treatment?
    1. Yes 2. No
29. If yes, what tablets he gave and what dietary advice he gave?
30. Do you consciously take less diet or skip meal to avoid becoming fat?
    1. Yes 2. No

D. ATTITUDE	Agree	Undecided	Disagree
1. There is no need to take increased diet during pregnancy.	A	U	D
2. Adolescent girls should eat well to become tall and healthy.	A	U	D
3. Adolescent girls should not marry until 21.	A	U	D
4. Learning about pregnancy is not important for adolescent girls.	A	U	D
5. Girls should not eat more as it will make them obese.	A	U	D
6. There is no difference between a woman who is short and a woman who is tall for pregnancy outcomes.	A	U	D
7. Adolescent girls are more affected by reduced/pale/ weakened blood than boys.	A	U	D

Name of the Investigator	Date of Visit	Edited by	Cross Checked by

APPENDIX - C
A PROGRAM TO PREVENT AND CONTROL ANEMIA AMONG PREGNANT WOMEN
ADOLESCENT GIRLS - POST EVALUATION SURVEY SCHEDULE - JULY 1998

Block No.	Panchayat No.	Subject No.

a) Subject Name : _____

b) Father's Name : _____

c) Street No. : _____

d) Village Name : _____
Panchayat

A. SOCIO-DEMOGRAPHIC INFORMATION

1. Religion : 1. Hindu 2. Christian 3. Muslim 4. Others
2. Caste : _____ 1. SC 2.BC 3. FC
3. Type of roof : 1. Thatched 2. Tiled 3. Terraced
4. Availability of Latrine : 1. NO 2. KUCTCHA 3. PUCCA
5. No. of rooms (Excluding Kitchen) :_____
6. Land (own) : a) Wet :_____acres b) Dry :_____acres
7. Type of Family : 1. Nuclear 2. Extended 3. Joint
8. Size of the Family :_____
9. Age (Completed Years) :_____ 10. Education (Completed):_____
11. a) What is your occupation?
    1. Full time employed outside 2. Studying & Outside work
    3. Studying & House work 4. Only house work 5. No work
    b) No. of Water pots per day 1. _____ 2. No
    c) Washing vessels & clothes daily 1. Yes 2. No
12. Age at menarche : _____
13. Mother's Education : _____
14. Father's Education : _____
15. Mother's Occupation : _____
16. Father's Occupation : _____

B. MEASUREMENTS

17. Hemoglobin :_____ g/dl
18. Presence of HW Ova : 1.Yes 2.No

C. KNOWLEDGE

19. What are the words you say for lack of blood and whiteness in the body (local term)
    1. Iratham Illai 2. Iratham Sundi Pochu 3. Iratha Sohai
    4. Vellai kaamalai 5. Varatu kaamalai 6. Oodhu Kaamalai
    7. Kaamalai 8. Udambu/kaikal Veluppu 9. Manjal Kaamalai
    99. DK

20. Have you heard of Iratha Sohai (Anemia)? 1.Yes 2.No
    a) What is Iratha Sohai?
21.a) Person/Place of Awareness 1. RUHSA-Village 2. GOVT 3. RUHSA - School
    b) Source/Method : 1. Hand bill 2. School 3. workshop
22.What are the causes of lack of blood among adolescent girls?
    1. Rapid Growth 2. Menstruation 3. Not eating properly
    4. HW Infestation 5. Others_____ 9. DK

23. Can you state who are all affected by the problem of reduced or weakened or pale blood?
    1. Pregnant women 2. Pre-school children 3. Adolescent girls
    4. Women in child bearing age 9. DK

24. How will you identify whether a adolescent girl has reduced/pale/weakened blood by looking at her?
    1. Whiteness in Tongue 2. Whiteness inside the eye lid
    3. Whiteness in Lips 4. Whiteness in Nail bed
    5. Spoonshaped Nail 6. Tiredness
    7. Breathlessness 9. DK

25. What happens (consequences) to a girl if the blood is reduced or weakened or becomes pale (anemia)?
    1. Cannot Work 2. Cannot Study 3. Affects growth
    4. Affects Future Pregnancy 9. Dk

26. How can we detect that a girl is having reduced/pale/weakened blood?
    1. Clinical signs 2. Blood test 9. DK
27. Do you think that reduced blood or Iratha Sohai will affect growth?
    1. Yes 2. No 9. DK

28. What should you do to increase or make the blood red or to prevent Iratha Sohai (anemia)?
    1. Eat Adequate Food 2. Eat green leafy vegetables frequently
    3. Wear Slippers when going out 4. Consume iron tablets
    5. Seek Medical help for menstruation problems 9. DK

29.What are the consequences of reduced/pale/weakened blood or Iratha Sohai to a pregnant women?
    1. LBW 2. Maternal deaths 3. Pre term delivery
    4. Abortions 5. Still birth 9. DK

30. What all should be followed in order to prevent the problems of reduced/pale/ weakened blood/Iratha Sohai during pregnancy?
    1. Consumption of IFA tablets 2. Increased food consumption
    3. Consumption of food that enhances iron absorption
    4. Avoiding food that prevents iron absorption
    5. Prevention of HW Infestation/Deworming/Wearing Slippers 9. DK

31. Are you aware of Irumbu Sathu Mathirai (iron & folic acid tablets) given to a pregnant women? 1. Yes 2. No

32. If yes can you tell a) How many tablets per day _____and
b) How long : From _____months To _____ months.

33. How does hookworm enter into the body?
1. Through foot 2. Through skin 9. DK

34.What does hookworm do when it enters the body?
1. Sucks the blood 9.DK

35. How can hookworm infection be prevented?
1. Deworming 2. By wearing slippers 9. DK

36. At what age should a girl get married? _____ age.

D. PRACTICE

37. Did you consume deworming tablets during the last one year?
a) No. of Tabs _____ b) No. of Days_____ c) No
d) Who advised you to take deworming tablets : Person _____
e) Where did you obtain : Place _____

38.Have you obtained/consumed IFA tablets any time since 1997?
a)1. Yes 2. No 3. DK
b) Place of IFA: _____ c) Who advised :_____

39. How many IFA a)Obtained _____ b) Consumed _____
40. Did you consciously take less diet or skip meal to avoid becoming fat?
1. Yes 2. No

E. ATTITUDE (Say whether you agree or disagree)

41. There is no need to take increased diet during pregnancy.	Ag	DAg	DK
42. Adolescent girls should eat well to become tall and healthy.	Ag	DAg	DK
43. Adolescent girls should not marry until 21	Ag	DAg	DK
44. Learning about pregnancy is NOT important for adolescent girls.	Ag	DAg	DK
45. Girls should NOT eat more as it will make them obese.	Ag	DAg	DK
46. Adolescent girls are more affected by reduced/pale/ weakened blood than boys.	Ag	DAg	DK

APPENDIX - D
ANEMIA CONTROL PROJECT
PREGNANT WOMEN - SURVEYED PANCHAYATS IN K.V.KUPPAM BLOCK

Table I : Sample Panchayats selected in K.V.Kuppam block and its population.

S.No.	PRE SURVEY		POST SURVEY	
	Panchayat Name	Popu-lation	Panchayat Name	Popu-lation
1.	Sethuvandai	3146	Ammanankuppam	1774
2.	Netteri	963	Veppur	3018
3.	Pasumathur	4447	Kilalathur	2519
4.	D. R. Kuppam	3477	Nagal	2525
5.	Kankuppam	3739	Kosavanpudur	1962
6.	Machanur	1579	Murukampet	2211
7.	Melmoil	4606	Alanganeri	1572
8.	Veppaneri	2129	Angarankuppam	1693
9.	Kilmuttukur	3302	Pillandipet	1433
10.	Panamadangi	3077	B N Palayam	2707
11.	Kalampattu	2477	Senji	4463
12.	Thondanthulasi	2061	Maliapattu	1878
13.	Latteri	6705	Vilunthakal	1264
14.	Thirumani	2683	Sozhamur	3854
15.	Annankudi	1959	Mudinampet	2586
16.	Velampet	1784	K.V.Kuppam	4035
17.	Kavasampet	2222	Kothamangalam	2292
18.	Vaduganthangal	4906	Arumbakkam	2637
19.	Kavanur	4123	P.K.Puram	3703
20.	Chennankuppam	2713	Chennankuppam	2713

APPENDIX - E

PREGNANT WOMEN - SURVEYED PANCHAYATS IN GUDIYATHAM BLOCK

Table II : Sample Panchayats selected in Gudiyatham block and its population.

S.No.	Name of the Panchayat PRE	Total	Name of the Panchayat POST	Total
1.	Chinnathottalam	1184	Goodanagaram	4648
2.	Thanakondapalli	2748	Melmuttukur	3321
3.	Erthangal	5306	Ananganallor	2453
4.	Goodanagaram	4648	Kothakuppam	1013
5.	Kallapadi	5996	Chinnathottalam	1184
6.	Melalathur	5996	Valathur	4751
7.	Melmuttukur	3321	Karunegar Samuthram	929
8.	Moongapattu	2311	Bojanapuram	2230
9.	Mukkundram	1641	Rajakuppam	1440
10.	Nellorepet	1956	Nellorepet	1956
11.	Pattavaripalli	2286	Seruvangi	2119
12.	Rajakuppam	1440	Thalaiyatham	1154
13.	Sempalli	5392	Seevoor	5206
14.	Sempedu	2694	Chinnalapalli	1462
15.	Senkundram	4203	Ramalai	6017
16.	Thattimanapalli	1702	Thattimanapalli	1702
17.	Ulli	3320	Varadhareddipalli	2456
18.	Varadhareddipalli	2456	Vilunthonpalayam	2046
19.	Veerichettipalli	4549	Dhanakondapalli	2748
20.	Villudhonpalayam	2046	Olakasi	2041
			Modikuppam	4500

APPENDIX - F

KEY INDICATORS USED FOR MONITORING AND EVALUATION

1. Number of Hand bills / Pamphlets printed and distributed

2. Number of Flash Cards set prepared and used

3. Number of Booklets printed and distributed

4. Number of Audio cassettes produced and used

5. Number of Video cassettes produced and used

6. Number of strategies developed for IEC

7. Number of Training organised for
   a) Volunteers b) RUHSA Staff c) Government Staff
8. Number of weekly review meetings held at PSU

9. Number of monthly meetings held at CSU

10. Number of ANC Registers maintained up to date

11. Up to date data entry of pregnant women ANC register

12. No. of pregnant women identified in 1st trimester

13. No. of pregnant women registered early

14. No. of pregnant women IFA procured

15. No. of pregnant women IFA consumed

16. Increased knowledge on anemia among pregnant women & adolescent girls

17. Decrease in the prevalence of anemia (Hb level) among pregnant women and adolescent girls

18. Decrease in the prevalence of Iron deficiency (SF level) among pregnant women and adolescent girls

19. Decrease in the prevalence of Hook worm infestation among pregnant women and adolescent girls.

APPENDIX - G
WORKSHOP ON ANEMIA FOR ADOLESCENT GIRLS IN K.V.KUPPAM BLOCK SYSTEMS APPROACH

1. INTRODUCTION:

Iron deficiency anemia is one of the most common nutritional deficiency diseases found in India. It particularly affects pre school children, adolescent girls, pregnant women and women of child bearing age. Anemia and iron depletion is common among adolescent girls because of the combined stress of growth and menstruation. Since girls in India marry and conceive at an early age majority of them are found to suffer from anemia. As a result many of them suffer adverse pregnancy outcomes. Anemia during adolescence can be prevented by iron supplementation. At present there is no such program of providing iron supplements to adolescent girls. However, anemia during adolescence can also be prevented by bringing about behavioural changes in the dietary intake. Secondly, it is also important that adolescent girls are aware of anemia during pregnancy and the prevention of it. Keeping the above in view a half day workshop is being organised for adolescent girls with the following goal. At the end of the workshop the adolescent girls will be equipped with the knowledge, attitude and skills of preventing anemia.

2. NEEDS ASSESSMENT

BASIC NEEDS of the adolescent girls will be identified by discussion with adolescent girls, qualitative report and through the experience of RUHSA Staff.

DESIRED LEVEL of the adolescent girls will be identified through individual and group discussion.

The ENTRY LEVEL of the adolescent girls will be assessed through quiz program.

3. GENERAL OBJECTIVES:

a) To discuss the growth changes during adolescence.
b) To describe causes, consequences and prevention of anemia during adolescence.
c) To discuss anemia during pregnancy.
d) To discuss menstrual problems during adolescence.

4. METHODOLOGY : Lecture, Demonstrations, Video and Games.
RESOURCE PERSONNEL :Dr. Sampathkumar, Mrs. Jayalakshmi, Mrs.Greeda, Mrs. Shanthi Jeevan, Mrs. Kumutham Ravi, Ms. Lilly John, Nurses & RCOs.

5. WORKSHOP IMPLEMENTATION:

Venue : CHEW or other appropriate place in the community.
Duration : Half day
Co.ordinator : Dr. V. Sampathkumar / Mrs. Jayalakshmi
Medium of Instruction: Tamil

6. EVALUATION:

a) Content Evaluation through quiz
b) Process Evaluation through group discussion

APPENDIX - H

WORKSHOP ON "ANEMIA FOR ADOLESCENT GIRLS"

CURRICULUM PLAN

DATE/TIME	TOPIC	OBJECTIVES	METHODOLOGY	RESOURCE PERSON
09.00 - 09.45	Growth during Adolescence	- To define adolescence - To state the changes during Puberty. - To discuss adolescent growth.	Lecture	Mrs. Kumutham Ravi / Mrs. Shanthi Jeevan / Nurses
09.45 - 10.45	Anemia during Adolescence	- To define anemia - To list the signs and symptoms and identification of anemia. - To state the perceptions of the community on anemia. - To state the causes of anemia during adolescence. - To list the consequence of anemia during adolescence. - To discuss the methods of preventing anemia during adolescence.	Lecture & Discussion	Dr. Sampathkumar / Mrs. Jayalakshmi
11.00 - 12.00	Anemia during Pregnancy	- To state the physiological changes during pregnancy. - To state the importance of antenatal care and early ANC registration. - To list the causes of anemia during pregnancy. - To list the consequences of anemia during pregnancy. - To discuss the dietary approach of preventing anemia during pregnancy. - To discuss the iron supplementation program to prevent anemia. - To discuss hookworm infestation and prevention.	Lecture, Demonstration & Video	Dr.Sampathkumar / Mrs. Jayalakshmi / RCOs
12.00 - 12.30	Menstrual Problems during adolescence	- To define normal flow in terms of quantity and duration. - To state the relationship between menstruation and anemia. - To list the menstrual problems of adolescent girls. - To state the methods of preventing menstrual problems.	Lecture & Discussion	Mrs. Shanthi Jeevan / Mrs. Kumutham Ravi/ Nurses
12.30 - 01.00	Post-Evaluation	- To assess the knowledge of the participants by the end of the training.	Quiz	Dr. Sampathkumar/ Mrs. Jayalakshmi

APPENDIX - I
WORKSHOP ON "ANEMIA FOR ADOLESCENT GIRLS"
POST EVALUATION SCHEDULE
04.05.98 TO 23.05.98

1. There is rapid growth during adolescence. Yes / No
2. Define Anemia.
3. Mention 3 signs and symptoms of anemia.
4. Specify the test that helps to detect anemia.
5. State 2 causes of anemia during adolescence.
6. State 2 causes of anemia during pregnancy.
7. Mention 2 consequences of anemia during adolescence.
8. Mention 3 consequences of anemia during pregnancy.
9. State 3 methods of preventing anemia during adolescence.
10. State 3 methods of preventing anemia during pregnancy.

APPENDIX - J

ANEMIA CONTROL RPOGRAM
ADOLOSCENT GIRLS - WORKSHOP IN SCHOOLS
PRE - POST TEST AVERAGE MARKS

SL NO	SCHOOLS IN KVK BLOCK	NO %	PRE %	POST	SIG LEVEL
1.	GOVT HR SEC SCHOOL SENJI	121	14.4	68.8	P<.001
2.	GOVT HIGH SCHOOL VADUGANTHANGAL	51	1.4	66.4	P<.001
3.	GOVT HIGH SCHOOL PASUMATHUR	55	2.2	73.6	P<.001
4.	GOVT HIGH SCHOOL R S GUDIYATHAM	72	1.0	65.6	P<.001
5.	GOVT HIGH SCHOOL KOSAVANPUDUR	89	3.1	48.4	P<.001
6.	GOVT HIGH SCHOOL BOYS&GIRLS LATTERI	234	3.3	65.6	P<.001
7.	GOVT HR SEC SCHOOL PILLANDIPATTU	130	10.9	70.1	P<.001
8.	GOVT HIGH SCHOOL MACHANUR	70	0.1	70.1	P<.001
9.	GOVT GIRLS HR SEC SCHOOL KVKUPPAM	272	2.5	93.6	P<.001
10.	GOVT BOYS HR SEC SCHOOL VEPPANERI	316	4.0	76.9	P<.001
		1410	4.29	69.92	P<.001

APPENDIX - K
ANEMIA CONTROL PROGRAM
ADOLESCENT GIRLS - COMMUNITY WORKSHOP
QUIZ SCORES

VILLAGE	NO OF PARTICI-PANTS	MARKS SCORED BY DIFFERENT GROUPS TOTAL MARKS = 50					AVERAGE GROUP SCORE
		GR I	GR II	GR III	GR IV	GR V	
1. CHENNANKUPPAM	33	45	29	46	-	-	40
2. KAVANUR	35	33	48	30	-	-	37
3. PILLANTHI PATTU	35	50	40	50	-	-	47
4. KILVILACHUR	57	20	32	32	22	20	25
5. MALIAPATTU	45	42	40	46	44	-	43
6. KALAMPATTU	29	50	50	50	-	-	50
7. SENJI	62	44	40	45	40	35	41
8. SENJI MOTTUR	44	35	48	50	50	-	46
9. VEPPANERI TEMPLE	36	47	20	50	-	-	39
10. VEPPANERI	40	38	26	36	20	20	28
11. LATTERI COLONY	43	30	30	30	26	-	29
12. LATTERI II	41	50	40	25	-	-	38
13. EDA KRISHNAPURAM	53	25	38	50	44	-	46
14. SHOLAMUR	54	50	32	20	-	-	34
15. ARUMBAKKAN	46	25	20	30	30	-	26
16. THONDANTHULASI	54	30	41	23	38	-	33
17. MELMANGKUPPAM	39	27	46	37	-	-	37
18. ALANGANERI	50	38	25	36	30	-	32
19. ANNANKUDI	42	20	27	39	30	-	29
20. THIRUMANI	30	45	33	22	-	-	33
21. KAVASAMPET	59	20	25	35	30	-	28
22. MUDINAMPET	41	20	47	31	-	-	33
23. PERUMANKUPPAM	36	20	20	44	36	-	30
24. KANKUPPAM	44	50	40	38	-	-	43
25. P.K PURAM	30	42	33	25	20	-	30
26. MACHANUR	35	30	40	25	32	-	32
27. KOSAVANPUDUR	41	32	30	23	25	-	28
28. PASUMATHUR MV	46	48	49	33	-	-	43
29. KRISHNAPURAM	42	35	49	42	-	-	42
30. ANGARANKUPPAM	38	42	20	40	22	-	31
31. D.R.KUPPAM	30	28	47	27	-	-	34
32. GEMMANKUPPAM	26	20	50	30	-	-	33
33. KEELALATHUR	34	38	23	35	23	-	30
34. SETHUVANDAI	34	48	48	40	-	-	45
35. VEPPUR	44	35	40	25	30	-	33
36. AMMANANKUPPAM	34	40	32	30	25	-	32
	1482					AVERAGE	36

APPENDIX - L

'A PROGRAM TO PREVENT AND CONTROL ANEMIA'

LIST OF IEC MATERIALS PREPARED AND USED

1. Hand bill on general information on anemia
2. Hand bill of messages on anemia
3. Flash Cards set on anemia in pregnancy
4. Booklet on anemia in pregnancy
5. Audio cassette with 8 songs and commentary
6. Video on anemia (20 mts)

1. HAND BILL ON GENERAL INFORMATION ON ANEMIA

1. Anemia is caused by iron deficiency in blood and it is common among pregnant women.
2. Our daily diet has sufficient amounts of iron needed for the body. Low intake of regular food will cause anemia.
3. Anemia is also caused by hookworm infestation.
4. Anemia is caused by early marriage and early conception.
5. Anemia is caused by frequent and less spaced pregnancies.
6. Drinking of tea and coffee soon after the meal will affect iron absorption and this will cause anemia.
7. Severely anemic pregnant women may become tired with whiteness of eyes, pallor of skin and spoon shaped nail.
8. Anemia can be detected by doing a blood test. Most important all pregnant women should have a blood test by 4th or 5th month.
9. Anemia during pregnancy may cause increased maternal morbidity and mortality.
10. Anemia during pregnancy may cause abortions, fetal morbidity and still birth deliveries.
11. Anemia during pregnancy may lead to delivery of low birth weight babies.

12. Pregnant women should start consuming iron tablets one per day from 4th month onwards until delivery.
13. Increase the diet during pregnancy by eating four or five times a day.
14. Meat, chicken and fish are good sources of iron and as well it promotes iron absorption. Eating these foods prevents anemia.
15. Consume lemon, orange, cabbage and amaranth regularly to promote iron absorption.
16. Hookworm infestation is treated by taking tablets which is given during pregnancy and this prevents anemia.
17. Always wear slippers while going out to prevent hookworm entering through the feet.
18. Girls should marry at 21 and delay the pregnancy for one year to prevent anemia during pregnancy and the complications arising out of it.
19. Space atleast three years between the first and the second child to prevent anemia.
20. Adolescent girls should be aware of the facts on anemia during pregnancy.
21. Iron tablets are available at RUHSA hospital, primary health centre, health subcentres, village health nurse, private hospitals and medical shops.
22. Pregnant women with severe anemia should have regular antenatal checkups and delivery at hospital.

2. HAND BILL OF MESSAGES ON ANEMIA

1. Anemia is caused by iron deficiency in blood and it is common among pregnant women.
2. Severely anemic pregnant women will have whiteness inside the eyelids, cheeks and tongue, spoon shaped nails, breathlessness and tiredness.
3. Anemia during pregnancy may cause abortions, still births, pre maturity, maternal deaths and most important delivery of low birth weight babies.
4. Normal food has sufficient amount of iron. Intake of less quantity of food during pregnancy causes anemia. Hence pregnant women should eat more food during pregnancy at least 4 to 5 times a day.
5. Consumption of tea or coffee soon after meals will affect iron absorption in blood.
6. Presence of hookworm in your stomach will cause anemia. Hookworm infestation can be treated by taking tablets which is given for 3 days, two tablets a day. Since hookworm enters through the feet this can be prevented by wearing slippers while going out.
7. Pregnant women should start consuming iron tablets one per day from the beginning of 4th month until delivery. Iron tablets are available at RUHSA Hospital, RUHSA Peripheral Service Unit (PSU) clinics, Primary Health Centers (PHC), Government sub-centers, Village Health Nurse (VHN) and from private medical shops.

4. BOOKLET MESSAGES ON ANEMIA (HEADINGS)

1. Anemia is caused by iron deficiency in blood and it is common among pregnant women.
2. Anemia is caused by low intake of iron rich foods and poor bio availability of iron.
3. Anemia is also caused by hookworm and schistoma, hematobium infection.
4. Anemia is caused by early marriage and early conception.
5. Anemia is caused by frequent and less spaced pregnancies.
6. Anemia during pregnancy may cause increased maternal morbidity and mortality increased fetal morbidity and mortality and increased risk of low birth weight.
7. All pregnant women should have a blood test for anemia by early 2nd trimester.
8. Pregnant women should start consuming iron tablets one per day from early 2^{nd} trimester until delivery.
9. Iron tablets are available at RUHSA Hospital, RUHSA PSU clinics, PHC, Sub centers, VHN and from private medical shops.
10. Consume larger amounts of normal food during pregnancy.
11. Consume lemon, orange, cabbage and amaranth to promote iron absorption.
12. Meat, chicken, and fish are good sources of iron and they promote iron absorption.
13. Drinking of tea and coffee soon after meals during pregnancy will affect iron absorption.
14. Hookworm and schistosoma is prevented by taking tablets which is given during pregnancy.
15. Always wear slippers while going out to prevent hookworm entering through the skin.
16. Girls should marry at 19 to prevent anemia during pregnancy and the complications arising out of it.
17. Space at least two years between first and second pregnancy to prevent anemia.
18. Adolescent girls should be aware of the facts on anemia during pregnancy.

5. AUDIO CASSETTE WITH 8 SONGS

SONG: 1 KANNAMMA - PONNAMMA

Kannamma, Chinnamma, Ponnamma

This is a story I am going to tell you, hear me
Every house there are door steps
Any one can get Anemia - Kannamma . . .

1. Kannamma . . . from the village Machanur
has become pregnant
Madavaram sister in law, Mother-in-law, Father-in-law
and 'Silk dothi' Mannaru (Husband) are all
celebrating (this pregnancy)
she told the happiest news to her husband'. - Kannamma . . .

2. She put the dot on her fore head
and put flowers on her head and
She wore a new saree
She put ornament on her fore head
and colorful bangles on her hand
She put Jasmine flower Garland and
To celebrate "valaikaappu"(A celebration during pregnancy)
. . . Mannaru - the husband ran happily to his house - Kannamma . . .

SONG: 2 RAAKKAMMA - RAAKKAMMA

Raakkamma . . . Raakkamma Do you know Anemia?
This is a disease of iron deficiency - Raakkamma

Raasaiya . . . Raasaiya
Paleness of tongue will come
Paleness of eye will come
Paleness of body also will occur
Spoon shape of nail also will come
Disease . . . This is a disease
happens during pregnancy.
Raasaiya . . . Raasaiya I know Anemia
Rakkamma . . . Rakkamma

Those who become pregnant should go to the doctor
After registration act safely - Raakkamma

Raasaiya . . . Raasaiya
I already saw the doctor
I took the tablets also (Iron tablets)
Daily one tablet.

Raakkamma . . . Raakkamma
To get a beautiful baby . . . Health is essential
For a happy prosperous life Red color tablets
Eat healthy foods . . . keep your body carefully

Raasaiya . . . Raasaiya
I know Anemia
This is a disease of Iron Deficiency.

SONG: 3 GREENS

Greens. . . Greens. . . Amaranth
Life will bloom'
Need . . . Need . . . Greens . . .
Come quickly and buy it.
Need . . . Need . . .
Come quickly to eat.

1. Pregnancy is the high time in women's life
   Anemia will bring sufferings, sadness
   Tears and hard time
   Greens will prevent all these . . . - Greens

2. Food should contain Iron in sufficient amount
   Sufferings and sadness may come to you
   Tears and Hard times will be prevented by Greens . . . - Greens

SONG: 4 DANCE

Clap oh . . lady . . Clap and Dance
For a Healthy Child - 2
Clap oh lady Clap and Dance
To prevent Anemia . . . Clap - 2

1. Iron deficiency will bring Anemia
   Hook worm infestation will bring Anemia
   Marriage in young age will bring Anemia
   Without spacing giving birth to many children will
   bring Anemia - Clap and Dance

2. Eyes, tongue and skin will turn pale
   Nail will be in spoon shaped and will get tiredness
   Some will not show signs and will become Anemic
   By blood test we will know Anemia - Clap and Dance

SONG: 5 THE BOAT FLOATS ON TEARS

The Boat is floating on Tears - May it reach the banks?
Thoughts are moving in my heart
She didn't see and went away
Oh my precious Dream can't you come again?
Oh you are my precious art

This world has forgotten you
But my heart never forgets you
Anemia - the disease killed you
This small disease brought death to you
I am unable to tolerate the sadness
This small disease will bring death
And changes the entire life - The boat floats

The Moon has gone away
My sadness never comes down
This simple disease could have been prevented
It separated us
This small disease can bring death
Intolerable sufferings will come to life
This small disease can bring death
and makes life uneasy - The boat floats

SONG: 6 COME LET US SING TOGETHER

Come to-gather all the people
Come and hear the message - 2
All pregnant mothers come together - 2
Come and know the causes of Anemia - 2

1. This disease is more common here
   Iron deficiency will bring this Anemia
   Oh pregnant mothers come together - 2
   Come and know the causes of Anemia
2. Marriage at young age will bring Anemia
   And pregnancy can bring Anemia
   Oh pregnant mothers come together
   Come and know the causes of Anemia

SONG: 7 NO BLOOD IN THE BODY

The blood amount is less
There is no blood in the body
Face became pale
hand and feet became pale
"Vellai kaamalai" - "Varattu Kaamalai"
"Oodu Kaamalai" - All these are Anemia

1. Iron deficiency will give Anemia
   Abortion may happen - the dream also will go away

2. Iron rich foods will increase the blood in the body
   Fetus grows well in the womb

3. Iron deficiency will give Anemia
   Low birth weight child will be born
   And still birth also will happen

SONG: 8 WHAT DO YOU WANT?

I am going to the meat stall dear
I will buy mutton and fish
Meat and fish will prevent Anemia

I am going to the fields
I will get Amaranth greens
Eating Amaranth will enhance
the iron absorption in the blood

I am going to the fruit market
I will buy Lime and Orange
Eating Lime and Orange will enhance the
iron absorption in the blood

I am going to the vegetable market
I will buy Cabbage
Eating Cabbage will enhance the absorption
of iron in the blood

Oh pregnant women eat well all the foods
Eating all the foods will prevent Anemia.

APPENDIX - M

LIST OF ALL PRODUCTS

1. IEC materials as in Appendix L

2. Reports

   a. Baseline quantitative report

   b. Base line qualitative report

      i. Provider and Client Perspectives on Anemia: Data from India - 97 pages

         - For Cross Site paper prepared by Dr Peggy

      ii. Formative Research for Designing Anemia Control Intervention / Experiences in Applying Qualitative and Participatory/Research Methods in India - 57 Pages

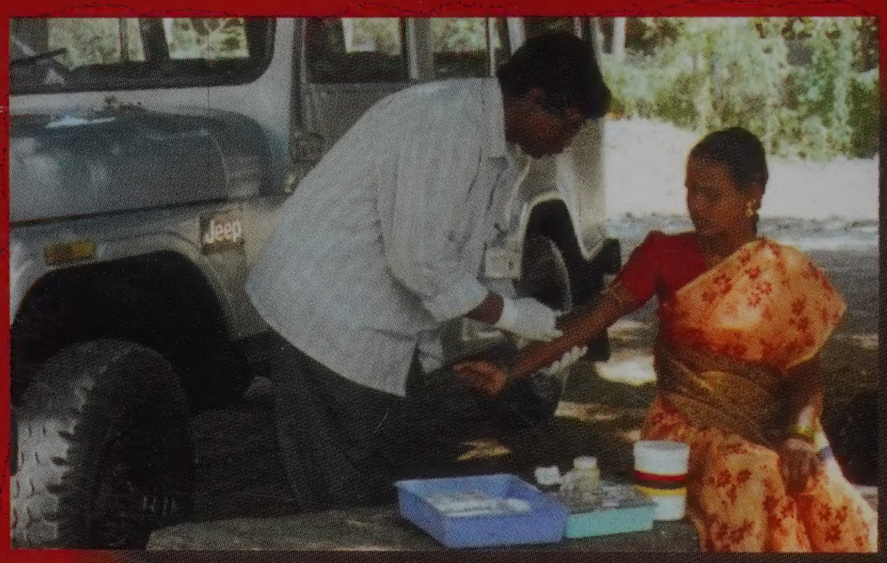
         - For Cross Site Paper prepare by Dr. Subhada

      iii. A Final Qualitative Report

   c. Nine Quarterly reports sent to Mother Care, USAID

   d. Final close out report (Out line given by Mother Care) - August,1998.

   e. Final project report - September, 1999.



Sri Padmavathi Offset. vlr.4 ph.22